

**OPERATOR HANDBOOK  
GUIDANCE  
ON  
ADAPTABLE PARAMETERS**

**DOPPLER METEOROLOGICAL RADAR  
WSR-88D**



OFFICE OF PRIMARY RESPONSIBILITY:  
NATIONAL WEATHER SERVICE RADAR OPERATIONS CENTER

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# Chapter 1

## Overview

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### 1.1 Introduction

The WSR-88D system was designed such that modifications to the hardware and software adaptable parameter settings can change their operating characteristics. These changes allow for system optimization based on meteorological, climatological, and regional variations, as well as user preferences.

Recognizing the rapidly changing operational environment and the Federal Meteorological Handbook Number 11 (FMH-11) update cycle, the Doppler Radar Meteorological Observations Working Group (DRMO-WG) chairman initiated the development of more responsive and user oriented adaptable parameters guidance documents. The WSR-88D Guidance on Adaptable Parameters Handbook Series, RPG, RDA, and PUP documents were designed to meet these requirements.

### 1.2 Policy

As mandated by the DRMO-WG, the WSR-88D Guidance on Adaptable Parameters Handbook, RPG has primacy in the area of RPG adaptable parameter guidance and supersedes all other adaptable parameter guidance, memos, and pamphlets issued prior to its publication. This handbook may be supplemented by agency or regional memoranda to clarify policy pertaining to parameters under Unit Radar Committee (URC) and Agency level of authority.

This document, as directed by FMH-11, Part A, serves to identify the specific adaptable parameters that fall under each Level of Change Authority (LOCA). It also defines the Radar Product Generator (RPG) system baseline adaptable parameter settings required to support the national radar network and provides guidance on certain URC and Agency level parameter changes, including parameter impacts and implications.

### 1.3 Level of Change Authority (LOCA) Philosophy

A hierarchy has been established to ensure maximum flexibility while maintaining data and operational integrity of the WSR-88D units. This hierarchy is divided into three distinct levels: Unit Radar Committee (URC) for changes that only affect the operation of their particular WSR-88D unit, Radar Operations Center (ROC) to address engineering, meteorological, and scientific parameters, and Agency to control parameters that only affect local operations. Each level controls those engineering, operational, and meteorological parameters that best apply to its level of expertise and responsibility.

The definition for each LOCA is provided in Chapter 2. Additionally, Chapter 2 lists each RPG adaptable parameter designated with a LOCA of URC or Agency and provides a cross-reference location into the appropriate chapter.

### 1.4 Document Design Characteristics

The "WSR-88D Guidance on Adaptable Parameters Handbook, Volume 4, RPG", is designed to facilitate ease of use. The handbook is divided into chapters in an order similar to the Human Computer Interface (HCI) screen of the RPG in the RPG Control/Status window.

Each major adaptable parameter subject area is addressed as a separate chapter. When there are additional subsets, such as Algorithms, those subsets are divided into sections, matching the display or the pull down menus that are used in the respective windows.

At the top of the RPG Control/Status window is a VCP XXX icon in the elevation radials extending from the radome (Figure 1-1). Click on this icon to bring up the VCP Control window for VCP Definitions.

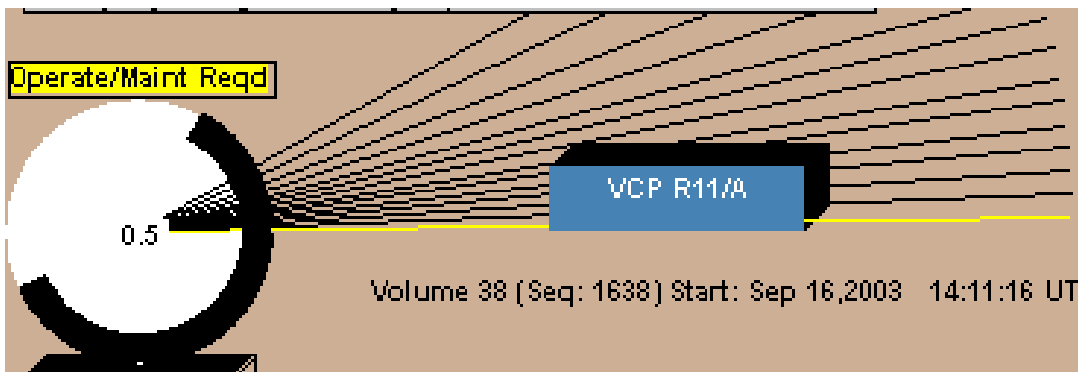


Figure 1-1. VCP Icon

When the RPG Products Icon (See Figure 1-2) is clicked, the RPG Products window (See Figure 1-3) appears and identifies five major areas of Adaptation Data. These are: Alert/Threshold, Generation List, Load Shed Products, Selectable Parameters, and Algorithms.

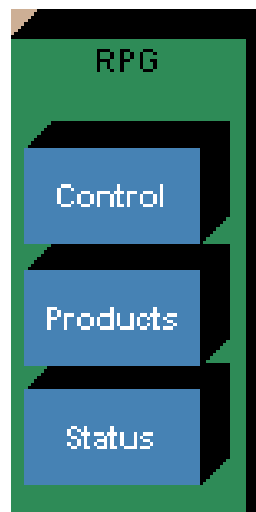


Figure 1-2. RPG Icon

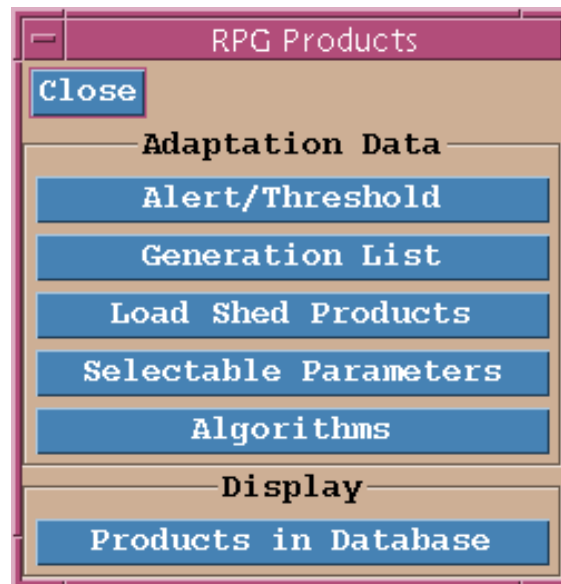


Figure 1-3. RPG Products Window

Next, inside the USERS icon, there are the Comms and Products buttons (Figure 1-4). The Comms button is used to select the Product Distribution Comms Status window, while the Products button is used to select the RPG Product Distribution Control window.

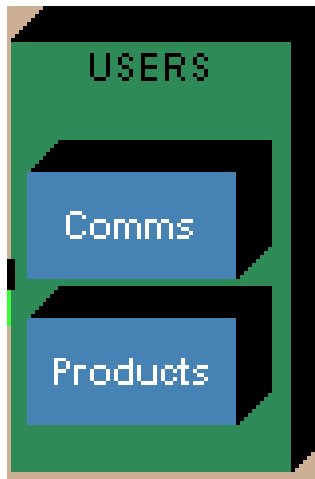


Figure 1-4. USERS Icons

Below the USERS icon is the Precip Cat: Text string that brings up the Precipitation Status window. See Figure 1-5 for NWS/DoD sites and Figure 1-6 for FAA sites.

Precip Cat:	NONE
VAD Update:	ON
Auto PRF:	ON
Calib: [ 0.00]:	AUTO
Load Shed:	Normal
Audio Alarms:	ENABLED
RDA Messages:	ENABLED

Figure 1-5. Precip Cat: (NWS/DoD)

Along the far right hand side are the Applications Icons (Figure 1-7).

Precip Cat:	NONE
VAD Update:	ON
Auto PRF:	ON
Calib: [ 0.00]:	AUTO
Load Shed:	Normal
Audio Alarms:	ENABLED
RDA Messages:	ENABLED
Adapt Times:	MATCH

Figure 1-6. Precip Cat: (FAA)



Figure 1-7. Applications Icons



The windows in this handbook are displayed as initially seen in the HCI. Several of the windows contain additional information that is available through vertical scroll bars on the right hand margin and/or horizontal scroll bars on the bottom margin. This additional information is not presented as figures in this handbook, but is available to the user in the HCI when the additional information/listings/edit fields are needed.

#### 1.4.1 Indicating LOCA Parameters

When adaptable parameters are under LOCA control, a padlock will appear in the upper right hand corner of the window. Click on the padlock and a Password window will appear with the LOCAs that affect that window. See Figure 1-8.



Figure 1-8. Password

Click on the desired LOCA and the editable field(s) for that LOCA will appear in white lettering. An example is found in Figure 1-9. Enter in the correct password for that LOCA and the padlock becomes open, turns to red, and identifies the LOCA. The editable field(s) then become sensitized, the background will turn to a light blue, and the digits turn to black.

**Modify Precipitation Detection Parameters**

Close Save Undo Baseline: Restore Update URC

Edit

Add Modify Delete

Tilt Domain	Precip Rate Thrsh (dBR)	Nominal Clutter Area (Km2)	Precip Area Thrsh (Km2)	Precip Cat	
0.0	2.0	-2.0	100	20	LIGHT (2)
0.0	4.0	4.0	150	10	SIGNIFICANT (1)
2.0	4.0	-2.0	80	20	LIGHT (2)

To edit, select an item from the table followed by Modify or Delete

---

**Modify Precipitation Table Item**

Close Apply

Min Elevation Angle ( -1.0 - 45.0 deg) 0.0

Max Elevation Angle ( -1.0 - 45.0 deg) 2.0

Precip Rate Thrshld (-30.0 - 50.0 dBR) -2.0

Nominal Clutter Area ( 0 - 80000 km2) 100

Precip Area Thrshld ( 0 - 80000 km2) 20

Precipitation Category LIGHT (2)

Figure 1-9. Example of Edit Field

For the purpose of this handbook, all the windows that have editable URC fields will have the URC LOCA clicked so the values show up as white letters/numbers. The operator may look at the other editable fields by clicking on the ROC or Agency button in the Password window, but will not be able to edit them unless the ROC or Agency password is known.

### 1.4.2 Supplemental Information

When information concerning a possible impact that changes to these parameters will have on the system or algorithm performance, a brief explanation is provided. When additional references are available, pertinent papers and articles are cross-referenced.

## 1.5 Adaptable Parameter Change Process

### 1.5.1 Emergency Changes

An emergency change request can be called into the WSR-88D Hotline and processed to the APWG chairperson as a Request for Technical Information (RTI).

### 1.5.2 Urgent Changes to ROC Controlled Adaptation Data Values

Under certain conditions, in order to best support local warning and forecast capabilities, individual sites may need to change the value of site-specific parameters which are controlled at the ROC LOCA. The need for change may result from local knowledge of radar performance or of other geographic, seasonal, and/or climatological effects. The timeliness of these changes may preclude the normal configuration change process procedures. In these cases, the site may submit an immediate parameter change request to the ROC using the following guidelines:

Requests may only be made by the Chairperson of the URC with the concurrence of the URC voting members. These requests will be made in writing to the Director of the ROC. The ROC will send a copy of the change request to the HQ AFWA/XPFC, HQ NWS W/OS12, and FAA NEXRAD Focal Point.

The Adaptable Parameter Working Group (APWG) technically evaluates the waiver parameter change request within 2 working days of receipt and then responds to the ROC Director.

The ROC Director, who is the signatory authority for delegating to sites the responsibility to make changes to ROC level parameters, responds in writing to the originator of the waiver parameter change request using standard agency procedures. In addition, the Director will deliver copies of the response to ROC Configuration Management (CM) and to the agency WSR-88D focal points.

The requesting site can implement the change upon approval from the ROC Director.

### 1.5.3 Routine Changes to ROC Controlled Adaptation Data

The triagencies may request routine changes to ROC-controlled adaptable parameter values. General guidance for DOC (NWS), DOD, and FAA Requests for Change (RC) is provided below.

NWS-originated parameter RC will first require the requesting office to submit its request to their regional headquarters WSR-88D focal point. If approved, the regional headquarters will forward the RC to the NWS NEXRAD Committee (NNC) for review. The NNC will forward approved requests to the ROC by memo to the ROC Director, with attention to the ROC CM Section.

DOD-originated parameter RCs should be submitted on AF FM 3215, C4 Systems Requirement Document. The request should then be submitted for local site approval, MAJCOM approval, then AFWA approval. If approved at all levels, HQ AFWA/XPFC will submit the CSR as a CCR via Agile to the ROC Director, with attention to the ROC CM section.

The FAA submits case files through their FAA NEXRAD focal point. If approved, the focal point will submit the request to the ROC Director, with attention to the ROC CM section.

RCs received by the ROC Director are forwarded to the ROC CM Section for processing into the Configuration Change Request (CCR) format. The CCR is forwarded to the APWG for their review and recommendation. If approved by the APWG, a recommendation is then forwarded to members of the ROC WSR-88D Configuration Control Board and to the ROC Director, who will approve or disapprove the recommended change. If the Director approves the change, the ROC CM Section will implement the change.

## Chapter 2

# Levels of Change Authority

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### 2.1 Authority Definitions

#### 2.1.1 Unit Radar Committee (URC)

The URC is authorized to change the values of WSR-88D adaptable parameters and establish adaptable parameter policy for the principal users within the URC, insofar as these changes affect only the operation of the URC's WSR-88D system. Changes that a single URC are authorized to implement are identified in Table 2-1 and Table 2-2 and may include the "fine tuning" needed to meet local operational requirements, seasonal changes, and local climatological characteristics.

#### 2.1.2 Radar Operations Center (ROC)

The ROC through the APWG is authorized to determine the general validity and range of adaptable parameter values for changes that involve technical and scientific characteristics of WSR-88D data acquisition and algorithmic processing. In addition, the ROC shall be authorized to determine, specifically, the values of the aforementioned default adaptable parameter values for WSR-88D equipment owned by DOD, DOT, and DOC. Since the APWG shall remain subordinate to the NEXRAD Program Management Committee (PMC), the ROC level of change authority shall reflect the PMC's position on triagency policy in WSR-88D operations.

#### 2.1.3 Agency

The DOD, DOT, and DOC, are authorized to change the values of adaptable parameters and establish WSR-88D adaptable parameter policy in order to meet their agency-specific mission requirements and criteria. Changes that a single agency are authorized to implement are identified in Table 2-3 and may involve user passwords and certain telecommunications settings.

## 2.2 URC LOCA Adaptable Parameters

Table 2-1 provides a listing of the RPG adaptable parameters under the change authority of the URC. Section numbers are provided identifying where additional information about the parameter can be found in this document.

Table 2-1. URC LOCA Adaptable Parameters

Parameter	Section
Alert Processing	<a href="#">4.1</a>
Clutter Suppression Region Baseline Restore & Update	<a href="#">12.1.1</a>
Combined Shear Domain (Resolution) [DOR]	<a href="#">8.2</a>
Combined Shear Threshold (Combined Shear) [THCS]	<a href="#">8.2</a>
Combined Shear Number (Filter) of Points [NFL]	<a href="#">8.2</a>
Combined Shear Elevation Cut to Process [ELEV]	<a href="#">8.2</a>
Hail Date [YY]	<a href="#">8.3</a>
Hail Date [MM]	<a href="#">8.3</a>
Hail Date [DD]	<a href="#">8.3</a>
Hail Height (0 Degrees Celsius)	<a href="#">8.3, 14.3</a>
Hail Height (-20 Degrees Celsius)	<a href="#">8.3, 14.3</a>
Hail Time [HH]	<a href="#">8.3</a>
Hail Time [MM]	<a href="#">8.3</a>
Hail Time [SS]	<a href="#">8.3</a>
Hydromet Adjustment Bias Flag	<a href="#">8.4</a>
Hydromet Preprocessing Max Allowable % Likelihood of Clutter [CLUTTHRES]	<a href="#">8.5</a>
Hydromet Preprocessing Number of Exclusion Zones [NEXZONE]	<a href="#">8.5</a>
Hydromet Preprocessing - Exclusion Zones (1-20)	<a href="#">8.5</a>
Hydromet Preprocessing Area with Reflectivity Exceeding Significant Rain Threshold [RAINA]	<a href="#">8.5</a>
Hydromet Preprocessing Reflectivity (dBZ) Representing Significant Rain [RAINZ]	<a href="#">8.5</a>
Maximum Number of Cells in STI Alphanumeric Product	<a href="#">7.1</a>
Maximum Number of Cells in SS Alphanumeric Product	<a href="#">7.1</a>
Maximum Number of Cells in Hail Alphanumeric Product	<a href="#">7.1</a>
Maximum Number of Cells in STI Attribute Table	<a href="#">7.1</a>

Table 2-1. URC LOCA Adaptable Parameters - Continued

Parameter	Section
Maximum Number of Cells in Combined Attribute Table	7.1
Maximum Number of Cells in Hail Attribute Table	7.1
MDA Minimum Reflectivity	8.7
MDA Overlap Display Filter	8.7
MDA Minimum Display Filter Rank	8.7
Nominal Clutter Area (Precipitation Detection)	11.3
One and Three Hour Precipitation Product Data Levels	7.4
RPG Control - Default Weather Mode	16.1
Snow Accumulation Minimum Height Correction	8.9
Snow Accumulation Range Height Correction Coefficient #1	8.9
Snow Accumulation Range Height Correction Coefficient #2	8.9
Snow Accumulation Range Height Correction Coefficient #3	8.9
Snow Accumulation Snow-Water Ratio	8.9
Snow Accumulation Z-S Multiplicative Coefficient	8.9
Snow Accumulation Z-S Power Coefficient	8.9
Storm Cell Components - Maximum Cell Based VIL Threshold	8.10.2
Storm Cell Tracking Default Storm Direction	8.11, 14.3
Storm Cell Tracking Default Storm Speed	8.11, 14.3
Storm Total Precipitation Product Data Levels	7.7
Velocity Azimuth Display (VAD) Beginning Azimuth Angle [TBZ]	8.13
Velocity Azimuth Display (VAD) Ending Azimuth Angle [TEZ]	8.13
Velocity Azimuth Display (VAD) Analysis Slant Range [VAD]	8.13
Velocity Data Levels	7.9
Velocity Dealiasing - Multi-PRF - Range Unfold Power Difference	8.14
Velocity Dealiasing - Multi-PRF - Fix Trip Minimum Bin	8.14
Velocity Dealiasing - Multi-PRF - Fix Trip Maximum Bin	8.14
URC Level Password	15.1

### 2.3 ROC-Level Adaptable Parameters Delegated to URC LOCA

To enable the field to "fine-tune" certain algorithm parameters, the ROC has delegated the change authority of selected parameters to the URC LOCA. The adaptable parameters in this category may only be modified in accordance to the guidance provided in this document. The limits of the URC authority and the range of allowable parameter selections are clearly defined in the Delegated Authority Restrictions subsection for each parameter. Table 2-2 lists the specific parameters delegated to the URC LOCA.

Table 2-2. ROC-Level Change Authority Delegated to URC-Level

Parameter	Section
Hail Detection POSH Offset	8.3
Hydromet Rate Max Precipitation Rate [MXPRA]	8.6
Hydromet Rate Z-R Multiplier Coef [CZM]	8.6
Hydromet Rate Z-R Exponent Coef [CZP]	8.6
Mesocyclone Minimum Number of Pattern Vectors [TPV]	8.8
Tornado Detection Algorithm (TDA) Minimum Reflectivity Threshold	<a href="#">8.12.1.1</a>
Tornado Detection Algorithm (TDA) Maximum Pattern Vector Range	<a href="#">8.12.1.2</a>
Tornado Detection Algorithm (TDA) Adaptable Parameter Set [LLDV, MDV, Depth]	<a href="#">8.12.2.2</a>
Tornado Detection Algorithm (TDA) Maximum # of Elevated TVSs	<a href="#">8.12.1.3</a>
VAD and RCM Height Selections	<a href="#">7.8</a>

### 2.4 Agency LOCA Adaptable Parameters

Table 2-3 provides a listing of the RPG adaptable parameters under the change authority of the Agency. Section numbers identify where additional parameter information can be found in this document.

Table 2-3. Agency LOCA Adaptable Parameters

Parameter	Section
Add Dial-In User Class	<a href="#">9.2.1</a>
Add Dial-In User Disconnect Override Privileges	<a href="#">9.2.1</a>
Add Dial-In User ID	<a href="#">9.2.1</a>
Add Dial-In User Maximum Connect Time Limit	<a href="#">9.2.1</a>
Add Dial-In User Name	<a href="#">9.2.1</a>
Add Dial-In User Password	<a href="#">9.2.1</a>
Agency Level Password	<a href="#">15.1</a>



## Chapter 3

# Volume Coverage Pattern (VCP) Definitions

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### 3.1 VCPs

The WSR-88D system supports two sets of volume coverage patterns. The "local" set is stored on the RDA hard drive and is not modifiable. The local set will not contain the new VCPs 12 and 121 until the Open Systems RDA is available. The VCPs 12 and 121 are only stored as a remote set in the RPG. The "remote" set of VCPs is stored on the RPG hard drive in adaptation data.

Local VCPs 11 and 21 are defined with predominantly PRF selection #5, while remote VCPs 11 and 21 are defined with predominantly PRF selection #4. With different PRF selections defined for the local and remote sets the operator can change the unambiguous range of the velocity data by simply switching between the local and remote VCPs. Additionally, the lower signal-to-noise ratio (SNR) threshold for the remote VCPs will allow more weak returns to be processed and displayed.

### 3.2 Changing VCPs

PRF selections can only be modified by making the target VCP the active VCP, then going into the PRF Selection (Modify Current VCP) window and making changes. This will only change the current PRF selections. Once the VCPs are invoked again either from the RPG or the RDA, the PRF selections will be restored to the baseline values.

To invoke one of the remote VCPs, download the desired VCP to the RDA. This is done by clicking on the VCP button and pulling up the VCP Control window. See Figure 3-1.

The screenshot shows a window titled "VCP Control" with a "Close" button in the top left. Below the title bar, there is a section for "Auto PRF:" with a green indicator light and the text "On", and an "Off" option with a radio button. The main content area is divided into two sections: "CHANGE to RDA VCP" and "DOWNLOAD VCP from RPG".

**CHANGE to RDA VCP**

Precipitation:	11	21
Clear Air:	31	32
Maintenance:	300	

**DOWNLOAD VCP from RPG**

Precipitation:	11	12	21	121
Clear Air:	31	32		
Maintenance:	300			

At the bottom, there are two rows of buttons. The first row has "Modify VCP:" followed by "Current" and "Adaptation". The second row has "Restart:" followed by "VCP" and "Elevation".

Figure 3-1. VCP Control

### 3.3 Range-Folded Data and VCPs

Doppler velocity estimates of some weather echoes may be obscured by range-folded data due to overlaid multiple-trip echoes. The operator can temporarily change the Pulse Repetition Frequency (PRF) to change the unambiguous range. Alternately, an operator can simply download VCP 121, the Multiple-PRF Dealiasing Algorithm (MPDA) scanning strategy with elevation angles matching VCP 21. Use VCP 121 when there are echoes in all quadrants and at various ranges from the radar as the simplest and easiest way to reduce range-folded data. While using VCPs 11, 12, and 21, operators can change the PRF for one or more sectors and one or more elevation angles. To modify the current VCP as a temporary change, edit the graphic edit screen (Figure 3-2) or the data table (Figure 3-3).

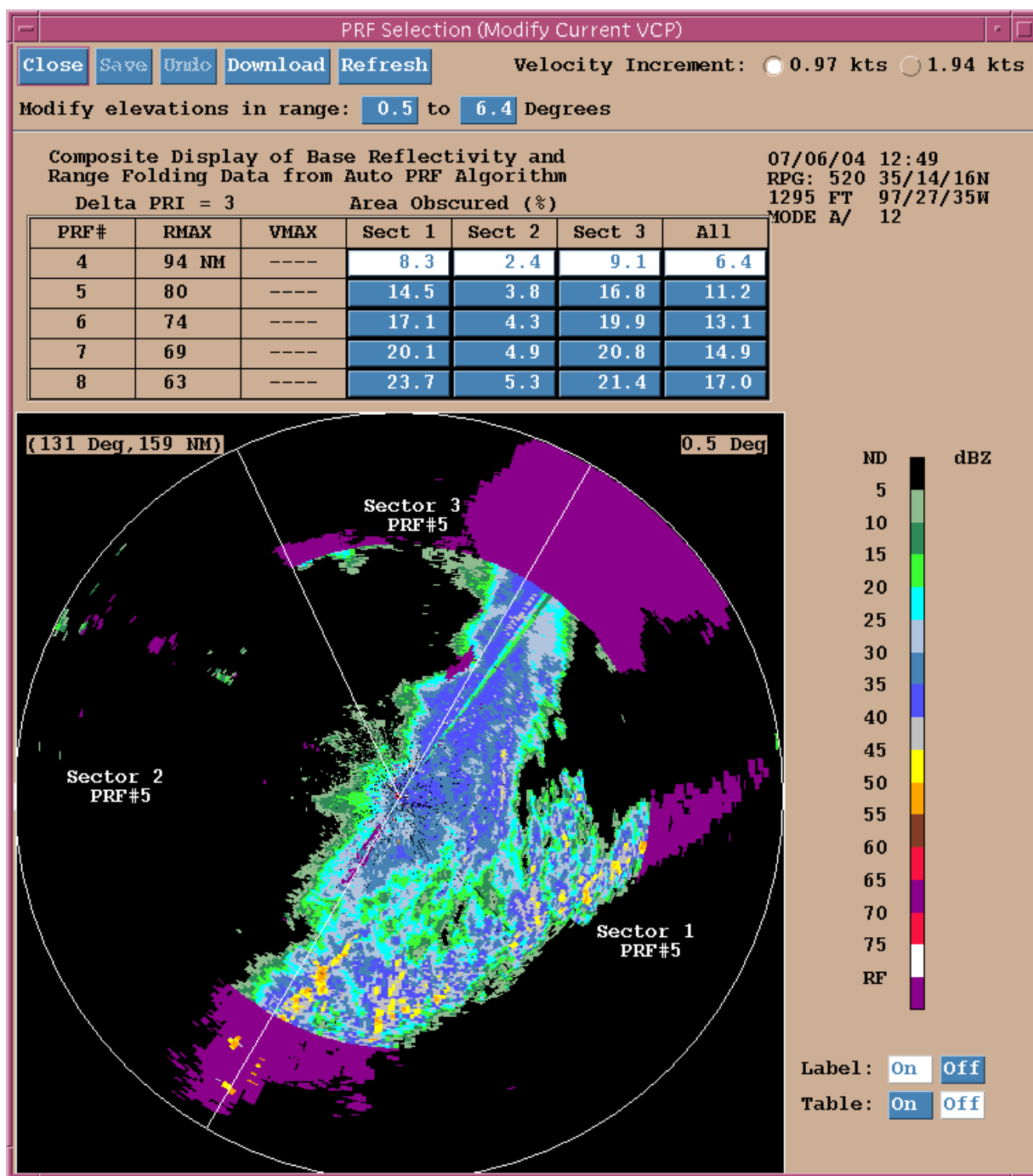


Figure 3-2. PRF Selection (Modify Current VCP)

Modify Current VCP Data

Close Undo Show: ☐ PRF# ☐ RHAX (NM) Velocity Increment: ☐ 0.97 kts ☐ 1.94 kts

#	Elevation	Degrees	Scan Seconds	Waveform	Sector 1		Sector 2		Sector 3		Signal/Noise Ratio (dB)	
					Azimuth	PRF #	Azimuth	PRF #	Azimuth	PRF #	Ref1	Vel
1	0.5	19	CS	0.0	1	0.0	1	0.0	1	2.00	2.00	2.00
2	0.5	19	CD/W	30.0	5	210.0	5	335.0	5	3.50	3.50	3.50
3	1.5	18	CS	0.0	1	0.0	1	0.0	1	2.00	2.00	2.00
4	1.5	19	CD/W	30.0	5	210.0	5	335.0	5	3.50	3.50	3.50
5	2.4	22	B	30.0	5	210.0	5	335.0	5	3.50	3.50	3.50
6	3.4	20	B	30.0	5	210.0	5	335.0	5	3.50	3.50	3.50
7	4.3	20	B	30.0	5	210.0	5	335.0	5	3.50	3.50	3.50
8	5.3	21	B	30.0	5	210.0	5	335.0	5	3.50	3.50	3.50
9	6.2	21	B	30.0	5	210.0	5	335.0	5	3.50	3.50	3.50
10	7.5	14	CD/WO	30.0	6	210.0	6	335.0	6	3.50	3.50	3.50
11	8.7	14	CD/WO	30.0	7	210.0	7	335.0	7	3.50	3.50	3.50
12	10.0	14	CD/WO	30.0	7	210.0	7	335.0	7	3.50	3.50	3.50
13	12.0	14	CD/WO	30.0	7	210.0	7	335.0	7	3.50	3.50	3.50
14	14.0	14	CD/WO	30.0	7	210.0	7	335.0	7	3.50	3.50	3.50
15	16.7	14	CD/WO	30.0	7	210.0	7	335.0	7	3.50	3.50	3.50
16	19.5	14	CD/WO	30.0	7	210.0	7	335.0	7	3.50	3.50	3.50

Azimuth Range: (0 to 359.9) - SNR Range: (-12.0 to 20.0 dB)

Figure 3-3. Modify Current VCP Data

### 3.4 Modify VCP Adaptation Data

In the VCP Control window, next to the bottom line, is the Modify VCP: Adaptation button. Click on the Adaptation button and the Modify VCP Adaptation Data window appears. See Figure 3-4 as an example. The window is password protected and is editable at the ROC level only. Seven windows are selectable for any remote VCP.

### 3.4.1 Modify VCP 11

Remote VCP 11 is defined with PRF selection #4 (unambiguous range of 94 nm) through 6.2 degree elevation (Figure 3-4), while the local VCP 11 (stored on the RDA hard drive) is defined with PRF selection #5 (unambiguous range of 80 nm). This adaptation data VCP is editable only at the ROC LOCA.

Modify VCP Adaptation Data

Close Save Undo Baseline: Restore Update

VCP Selection

☐ 11 ☐ 12 ☐ 21 ☐ 31 ☐ 32 ☐ 121 ☐ 300

Show: ☐ PRF# ☐ RHAX (NM) Velocity Increment: ☐ 0.97 kts ☐ 1.94 kts

#	Elevation		Scan Seconds	Waveform Type	Sector 1		Sector 2		Sector 3		Signal/Noise Ratio (dB)	
	Degrees	PRF #			Azimuth	PRF #	Azimuth	PRF #	Refl	Vel	Width	
1	0.5	19	CS									
2	0.5	19	CD/W	30.0	4	210.0	4	335.0	4	3.50	2.00	2.00
3	1.5	18	CS									
4	1.5	19	CD/W	30.0	4	210.0	4	335.0	4	3.50	2.00	2.00
5	2.4	22	B	30.0	4	210.0	4	335.0	4	3.50	3.50	3.50
6	3.4	20	B	30.0	4	210.0	4	335.0	4	3.50	3.50	3.50
7	4.3	20	B	30.0	4	210.0	4	335.0	4	3.50	3.50	3.50
8	5.3	21	B	30.0	4	210.0	4	335.0	4	3.50	3.50	3.50
9	6.2	21	B	30.0	4	210.0	4	335.0	4	3.50	3.50	3.50
10	7.5	14	CD/WO	30.0	6	210.0	6	335.0	6	3.50	3.50	3.50
11	8.7	14	CD/WO	30.0	7	210.0	7	335.0	7	3.50	3.50	3.50
12	10.0	14	CD/WO	30.0	7	210.0	7	335.0	7	3.50	3.50	3.50
13	12.0	14	CD/WO	30.0	7	210.0	7	335.0	7	3.50	3.50	3.50

Azimuth Range: (0 to 359.9 Deg) - SNR Range: (-12.0 to 20.0 dB)

Figure 3-4. Modify VCP Adaptation Data - VCP 11

### 3.4.2 Modify VCP 12

Remote VCP 12 is defined with PRF selection #5 (unambiguous range of 80 nm) through 6.4 degrees elevation (Figure 3-5). There is no local version of VCP 12 until ORDA is fielded. This adaptation data VCP is editable only at the ROC LOCA.

Close Save Undo
Baseline: Restore Update
Modify VCP Adaptation Data

VCP Selection
Velocity Increment: ☐ 0.97 kts ☐ 1.94 kts

Show: ☐ PRF# ☐ RNAX (NM)

Elevation		Scan		Sector 1		Sector 2		Sector 3		Signal/Noise Ratio (dB)	
#	Degrees	Seconds	Type	Azimuth	PRF #	Azimuth	PRF #	Azimuth	PRF #	Ref1	Width
1	0.5	17	CS	0	1	0	1	0	1	2.00	2.00
2	0.5	14	CD/W	30.0	5	210.0	5	335.0	5	3.50	3.50
3	0.9	17	CS	0	1	0	1	0	1	2.00	2.00
4	0.9	14	CD/W	30.0	5	210.0	5	335.0	5	3.50	3.50
5	1.3	17	CS	0	1	0	1	0	1	2.00	2.00
6	1.3	14	CD/W	30.0	5	210.0	5	335.0	5	3.50	3.50
7	1.8	15	B	30.0	5	210.0	5	335.0	5	3.50	3.50
8	2.4	14	B	30.0	5	210.0	5	335.0	5	3.50	3.50
9	3.1	14	B	30.0	5	210.0	5	335.0	5	3.50	3.50
10	4.0	14	B	30.0	5	210.0	5	335.0	5	3.50	3.50
11	5.1	13	B	30.0	5	210.0	5	335.0	5	3.50	3.50
12	6.4	13	B	30.0	5	210.0	5	335.0	5	3.50	3.50
13	8.0	13	CD/WO	30.0	6	210.0	6	335.0	6	3.50	3.50

Azimuth Range: (0 to 359.9 Deg) -
SNR Range: (-12.0 to 20.0 dB)

Figure 3-5. Modify VCP Adaptation Data - VCP 12

### 3.4.3 Modify VCP 21

Remote VCP 21 is defined with a PRF selection #4 (unambiguous range of 94 nm) through 6.0 degrees elevation, while the local VCP 21 (stored on the RDA hard drive) is defined with PRF selection #5 (unambiguous range of 80 nm). See [Figure 3-6](#). This adaptation data VCP is editable only at the ROC LOCA.

Close Save Undo Baseline: Restore Update

Modify VCP Adaptation Data

VCP Selection: 11 12 21 31 32 121 300

show: ☐ PRF# ☐ RMAX (NM) ☒ Velocity Increment: ☐ 0.97 kts ☐ 1.94 kts

Elevation		Scan		Sector 1		Sector 2		Sector 3		Signal/Noise Ratio (dB)	
#	Degrees	Seconds	Waveform Type	Azimuth	PRF #	Azimuth	PRF #	Azimuth	PRF #	Refl	Vel
1	0.5	32	CS	30.0	4	210.0	4	335.0	4	2.00	2.00
2	0.5	32	CD/W	30.0	4	210.0	4	335.0	4	3.50	3.50
3	1.5	32	CS	30.0	1	0	1	0	1	2.00	2.00
4	1.5	32	CD/W	30.0	4	210.0	4	335.0	4	3.50	3.50
5	2.4	32	B	30.0	4	210.0	4	335.0	4	3.50	3.50
6	3.4	32	B	30.0	4	210.0	4	335.0	4	3.50	3.50
7	4.3	32	B	30.0	4	210.0	4	335.0	4	3.50	3.50
8	6.0	32	B	30.0	4	210.0	4	335.0	4	3.50	3.50
9	9.9	25	CD/WO	30.0	7	210.0	7	335.0	7	3.50	3.50
10	14.6	25	CD/WO	30.0	7	210.0	7	335.0	7	3.50	3.50
11	19.5	25	CD/WO	30.0	7	210.0	7	335.0	7	3.50	3.50

Azimuth Range: (0 to 359.9 Deg) - SNR Range: (-12.0 to 20.0 dB)

Figure 3-6. Modify VCP Adaptation Data - VCP 21

### 3.4.4 Modify VCP 31

The PRF selections for VCP 31 are not editable (Figure 3-7).

Close Save Undo Baseline: Restore Update

Modify VCP Adaptation Data

Show: ☐ PRF# ☐ RHAX (NM)

Velocity Increment: ☒ 0.97 kts ☐ 1.94 kts

VCP Selection: ☐ 11 ☐ 12 ☐ 21 ☒ 31 ☐ 32 ☐ 121 ☐ 300

Elevation		Scan Waveform		Sector 1		Sector 2		Sector 3		Signal/Noise Ratio (dB)	
#	Degrees	Seconds	Type	Azimuth	PRF #	Azimuth	PRF #	Azimuth	PRF #	Ref1	Width
1	0.5	71	CS	0	1	0	1	0	1	0.00	0.00
2	0.5	71	CD/W	30.0	2	210.0	2	335.0	2	0.00	0.00
3	1.5	71	CS	0	1	0	1	0	1	0.00	0.00
4	1.5	71	CD/W	30.0	2	210.0	2	335.0	2	0.00	0.00
5	2.5	71	CS	0	1	0	1	0	1	0.00	0.00
6	2.5	71	CD/W	30.0	2	210.0	2	335.0	2	0.00	0.00
7	3.5	71	CD/WO	30.0	2	210.0	2	335.0	2	0.00	0.00
8	4.5	71	CD/WO	30.0	2	210.0	2	335.0	2	0.00	0.00

Azimuth Range: (0 to 359.9 Deg)
SNR Range: (-12.0 to 20.0 dB)

Figure 3-7. Modify VCP Adaptation Data - VCP 31



## 3.4.5 Modify VCP 32

Remote VCP 32 has the same PRF selections as the local VCP 32 (Figure 3-8). This adaptation data VCP is editable only at the ROC LOCA.

Modify VCP Adaptation Data

Close Save Undo Baseline: Restore Update

VCP Selection

☐ 11 
 ☐ 12 
 ☐ 21 
 ☐ 31 
 ☒ 32 
 ☐ 121 
 ☐ 300

Show: ☐ PRF# ☐ RMAX (NM) Velocity Increment: ☐ 0.97 kts ☐ 1.94 kts

Elevation		Scan Waveform		Sector 1		Sector 2		Sector 3		Signal/Noise Ratio (dB)	
#	Degrees	Seconds	Type	Azimuth	PRF #	Azimuth	PRF #	Azimuth	PRF #	Ref1	Width
1	0.5	72	CS	0	1	0	1	0	1	0.50	0.50
2	0.5	79	CD/W	30.0	5	210.0	5	335.0	5	0.50	0.50
3	1.5	72	CS	0	1	0	1	0	1	0.50	0.50
4	1.5	79	CD/W	30.0	5	210.0	5	335.0	5	0.50	0.50
5	2.5	89	B	30.0	5	210.0	5	335.0	5	1.00	1.00
6	3.5	89	B	30.0	5	210.0	5	335.0	5	1.00	1.00
7	4.5	89	B	30.0	5	210.0	5	335.0	5	1.00	1.00

Azimuth Range: (0 to 359.9 Deg) - SNR Range: (-12.0 to 20.0 dB)

Figure 3-8. Modify VCP Adaptation Data - VCP 32

### 3.4.6 Modify VCP 121

The Remote VCP 121 collects data at nine unique elevation angles in every five minutes using a total of 20 sweeps. Multi-PRF Dealiasing Algorithm (MPDA) is applied to the first 5 elevation angles while Velocity Dealiasing Algorithm (VDA) is used for the remaining four higher elevation angles. The scanning sequence is defined in Figure 3-9, Modify VCP Adaptation Data - VCP 121. This adaptation data VCP is editable only at the ROC LOCA.

The veldeal task has been modified to include not only the legacy VDA but also the MPDA. The main veldeal task, on activation, determines the Volume Coverage Pattern (VCP) number of the incoming data. Based on the VCP number it then calls either the VDA or MPDA buffer control modules. The respective buffer control modules process the incoming raw base data until an end of elevation or an end of volume condition is detected and veldeal becomes inactive. VCP 121, when downloaded from the RPG to the RDA, causes the veldeal task to initiate the MPDA processing. This VCP has the same elevation angles as VCP 21, but completes a volume scan every 5 rather than 6 minutes.

Modify VCP Adaptation Data

Close Save Undo Baseline: Restore Update

VCP Selection

☐ 11 ☐ 12 ☐ 21 ☐ 31 ☐ 32 ☒ 121 ☐ 300

Show: ☐ PRF# ☐ RMAX (NM) Velocity Increment: ☐ 0.97 kts ☐ 1.94 kts

Elevation		Scan		Waveform		Sector 1		Sector 2		Sector 3		Signal/Noise Ratio (dB)	
#	Degrees	Seconds	Type	Azimuth	PRF #	Azimuth	PRF #	Azimuth	PRF #	Refl	Vel	Width	
1	0.5	12	CS	0	1	0	1	0	1	2.00	2.00	2.00	
2	0.5	12	CD/W	30.0	8	210.0	8	335.0	8	3.50	3.50	3.50	
3	0.5	13	CD/WO	30.0	6	210.0	6	335.0	6	3.50	3.50	3.50	
4	0.5	17	CD/WO	30.0	4	210.0	4	335.0	4	3.50	3.50	3.50	
5	1.5	12	CS	0	1	0	1	0	1	2.00	2.00	2.00	
6	1.5	12	CD/W	30.0	8	210.0	8	335.0	8	3.50	3.50	3.50	
7	1.5	13	CD/WO	30.0	6	210.0	6	335.0	6	3.50	3.50	3.50	
8	1.5	17	CD/WO	30.0	4	210.0	4	335.0	4	3.50	3.50	3.50	
9	2.4	19	B	30.0	8	210.0	8	335.0	8	3.50	3.50	3.50	
10	2.4	13	CD/WO	30.0	6	210.0	6	335.0	6	3.50	3.50	3.50	
11	2.4	17	CD/WO	30.0	4	210.0	4	335.0	4	3.50	3.50	3.50	
12	3.3	17	B	30.0	8	210.0	8	335.0	8	3.50	3.50	3.50	
13	3.3	13	CD/WO	30.0	6	210.0	6	335.0	6	3.50	3.50	3.50	

Azimuth Range: (0 to 359.9 Deg) - SNR Range: (-12.0 to 20.0 dB)

Figure 3-9. Modify VCP Adaptation Data - VCP 121

### 3.4.7 Modify VCP 300

The Remote VCP 300 is used during maintenance for diagnostic purposes and is not an operational VCP (Figure 3-10). This adaptation data VCP is editable only at the ROC LOCA.

#### NOTE

This function is not applicable with a DRS Weather Systems, Inc RDA.

Close Save Undo Baseline: Restore Update Cancel

Modify VCP Adaptation Data

VCP Selection: 11 12 21 31 32 121 300

Show: PRF# RMAX (NM) Velocity Increment: 0.97 kts 1.94 kts

Elevation		Scan Waveform		Sector 1		Sector 2		Sector 3		Signal/Noise Ratio (dB)	
#	Degrees	Seconds	Type	Azimuth	PRF #	Azimuth	PRF #	Azimuth	PRF #	Refl	Width
1	0.5	32	CS	0	1	0	1	0	1	-1.50	-1.50
2	0.5	32	CD/W	30.0	5	210.0	5	335.0	5	4.12	4.12
3	2.4	32	B	30.0	5	210.0	5	335.0	5	3.12	3.12
4	9.9	25	CD/WO	30.0	7	210.0	7	335.0	7	3.12	3.12

Azimuth Range: (0 to 359.9 Deg)
SNR Range: (-12.0 to 20.0 dB)

Figure 3-10. Modify VCP Adaptation Data - VCP 300

## Chapter 4

# RPG Products - Alert/Threshold

---

### 4.1 Alert Processing

The WSR-88D alerting function will search data fields and algorithm output data to identify any phenomena selected as an alert criteria within the area designated by any associated user. The exception is the MAX 1HR PRECIP alert which is not restricted to the alert area definition. Upon detection of alert criteria being met, the alerting function notifies the affected associated user(s) and, if specified, will generate and automatically distribute an alert-paired product to the appropriate associated user(s).

### 4.2 Alert Thresholds

The Alert Thresholds are divided into three groups of products: Grid, Volume and Forecast. These three windows are displayed as Figure 4-1, Figure 4-2, and Figure 4-3. All three are displayed with the URC LOCA clicked and the editable fields are white letters/numbers.

Within each of these groups are the category of the products and up to six thresholds (Th1 through Th6) that can be defined. Individual threshold values should be selected to meet the local requirements of all Associated Users. All alert processing functions search the data fields out to 124 nm for each alert category except for the following eight alert categories:

- Grid Velocity - The base velocity data field is only searched to 62 nm.
- Grid Composite Refl. - The Composite reflectivity data field is processed out to 186 nm.
- Volume VAD - Only the lowest VWP height is used to trigger this alert.
- Volume TVS - A TVS must be identified within 62 nm to trigger this alert.
- Volume Max Storm Refl - The storm cell can be out to 248 nm.
- Volume Storm Top - The storm cell can be out to 248 nm.
- Forecast TVS - The forecasted position of the storm cell containing the TVS must fall within 62 nm.
- Forecast Max Storm Refl - The forecasted position of the storm cell can be out to 248 nm.

Alert Threshold Editor

Baseline:

Group: ☒ Grid ☐ Volume ☐ Forecast

Category	Units	Min	Max	Th1	Th2	Th3	Th4	Th5	Th6	Paired Product
Velocity	kts	0	246	15	25	35	45	50	60	[44] - SWV Severe Weather (Velocity)
Composite Refl	dBZ	-32	95	20	30	40	50	60	70	[38] - CR Composite Reflectivity
Echo Tops	kft	0	70	30	40	50	60			[41] - Et Echo Tops: 16 level/2.2
SVR wx Prob	%	0	100	30	40	50	60	70		[47] - SWP Severe Weather Probability
WIL	kg/m2	0	80	35	40	45	50	55	65	[57] - VIL Vertically Integrated

Figure 4-1. Alert Threshold Editor - Grid

Alert Threshold Editor

Group: ☐ Grid ☒ Volume ☐ Forecast

Category	Units	Min	Max	Th1	Th2	Th3	Th4	Th5	Th6	Paired Product
VAD	kts	0	246	15	20	25	30	35	40	[84] - VAD Velocity Azimuth Displ
Max Hail Size	1/4 in	1	16	1	2	3	4	5	6	[59] - HI Hail Index
Mesocyclone		1	3	1	2	3				[55] - SRR Storm Relative Velocity
TVS		1	2	1	2					[61] - TVS Tornado Vortex Signatu
Max Storm Refl	dBZ	-32	95	35	40	45	50	55	60	[50] - RCS Cross Section (Reflect
prob Hail	%	0	100	10	20	30	50	70	90	[44] - SNW Severe Weather (Veloci
prob SVR Hail	%	0	100	10	20	30	50	70	90	[38] - CR Composite Reflectivity
Storm Top	kft	0	70	20	30	40	50	60	70	[41] - ET Echo Tops: 16 level/2.2
Max 1hr Precip	1/10 in	0	160	10	20	30	40			[78] - OHP Surface Rainfall Accum

Mesocyclone: 1 = Uncorr Shear, 2 = 3D Corr Shear, 3 = Mesocyclone - TVS: 1 = ETVS Detected, 2 = TVS Detected

Figure 4-2. Alert Threshold Editor - Volume

Alert Threshold Editor

Group: ☐ Grid ☒ Volume ☐ Forecast

Category	Units	Min	Max	Th1	Th2	Th3	Th4	Th5	Th6	Paired Product
Max Hail Size	1/4 in	1	16	1	2	3	4	5	6	[59] - HI Hail Index
Mesocyclone		1	3	1	2	3				[55] - SRR Storm Relative Velocity
TVS		1	2	1	2					[61] - TVS Tornado Vortex Signature
Max Storm Refl	dBZ	-32	95	35	40	45	50	55	60	[50] - RCS Cross Section (Reflectivity)
prob Hail	%	0	100	10	20	30	50	70	90	[44] - SWW Severe Weather (Velocity)
prob SVR Hail	%	0	100	10	20	30	50	70	90	[38] - CR Composite Reflectivity
Storm Top	kft	0	70	20	30	40	50	60	70	[41] - ET Echo Tops: 16 level/2.2

Mesocyclone: 1 = Uncorr Shear, 2 = 3D Corr Shear, 3 = Mesocyclone      -      TVS: 1 = ETVS Detected, 2 = TVS Detected

Figure 4-3. Alert Threshold Editor - Forecast



### **4.3 Product Alert Pairing**

When an alert is identified for any associated user, the alert processing function will initiate a one-time request for the paired product specified in the Paired Product column of the Alert Threshold Editor.

Select the RPG Products icon and select the Alert/Threshold button to display the Alert Threshold Editor window. Click on the padlock and enter the URC password. Once the URC password is successfully entered, a pull down menu is then available for selecting an appropriate paired product. The pull down menus vary from one product to another. Some have the entire list of products available. Others, such as elevation based products, have a shorter list with just similar elevation based products available.

Products that are not available as a paired product for any alert category include:

- USP, #31: User Selectable Storm Total Precipitation
- DHR, #32: Digital Hybrid Scan Reflectivity
- HSR, #33: Hybrid Scan Reflectivity
- CFC, #34: Clutter Filter Control
- UAM, #73: User Alert Message
- FTM, #75: Free Text Message
- DBV, #93: ITWS Digital Velocity Product
- DR, #94: Base Reflectivity Data Array Product
- DV, #99: Base Velocity Data Array Product
- CLR, #132: Clutter Likelihood Reflectivity
- CLD, #133: Clutter Likelihood Doppler
- SO, #136: Superob: NCEP Winds Model Initialization
- ULR, #137: User Selectable Layer Composite Reflectivity (Maximum)
- DSP, #138: Digital Storm Total Rainfall Accumulation
- MRU, #139: Mesocyclone Rapid Update
- MD, #141: Mesocyclone Detection Product
- TRU, #143: Tornado Detection Rapid Update Product
- OSE, #144: One-Hour Snow Accumulation (Water Equiv.)
- OSD, #145: One-Hour Snow Accumulation (Depth)
- SSW, #146: Storm Total Snow Accumulation (Water Equiv.)
- SSD, #147: Storm Total Snow Accumulation (Depth)
- DMD, #149: Mesocyclone Detection Data Array Product

- USW, #150: User Selectable Snow Accumulation (Water Equiv.)
- USD, #151: User Selectable Snow Accumulation (Depth)

## Chapter 5

# RPG Products - Generation List

---

### 5.1 Product Generation List Windows

The product generation list is available in four separate tables under the RPG Product Generation Table Editor window. The information provided in these windows ensures product generation to support the requirements of the National Archives and all non-associated and other users. Associated user product availability is not affected by these windows.

#### 5.1.1 Current Generation List.

To open the window, select RPG Products, then Generation List. The Current Table is displayed as the default. See [Figure 5-1](#).

Just the top portion of the Current window is shown - Products 16 through 32 - as an example. Use the scroll bar on the right hand side of the window to display the entire table. For a complete listing of the default generation lists for the precipitation, clear air, and maintenance modes, continue on in this chapter.

There are four columns that are editable by the site. These are Generation (Gen), Storage (Sto), Minutes of Storage ((mins)), and Elevation Cuts (Elev/Cut(s)). These are not password protected and can be changed at any time.

The Current list is maintained in memory and is used to determine the RPG's contribution to the master product generation and distribution list for the current volume scan. This listing is temporary and is replaced each time the RPG is rebooted or the weather mode changes.

RPG Product Generation Table Editor

Close Save Undo Table: ☒ Current ☐ Precip (A) ☐ Clear Air (B) ☐ Maintenance

Replace Current Table with: ☐ Precip Mode (A) ☐ Clear Air Mode (B) ☐ Maintenance Mode

Search:  Sort by: ☐ Product Code ☐ Product MNE ☐ Description

MNE	Code	Gen	Sto	(mins)	Elev/Cut(s)	Product Description
R	16	0	0	0	0	Base Reflectivity: 8 level/0.54 nm
R	17	0	0	0	0	Base Reflectivity: 8 level/1.1 nm
R	18	1	1	180	-1	Base Reflectivity: 8 level/2.2 nm
R	19	1	1	180	-4	Base Reflectivity: 16 level/0.54 nm
R	20	1	1	180	-3	Base Reflectivity: 16 level/1.1 nm
R	21	0	0	0	0	Base Reflectivity: 16 level/2.2 nm
V	22	0	0	0	0	Base Velocity: 8 level/0.13 nm
V	23	0	0	0	0	Base Velocity: 8 level/0.27 nm
V	24	1	1	180	-1	Base Velocity: 8 level/0.54 nm
V	25	1	1	180	-1	Base Velocity: 16 level/0.13 nm
V	26	1	1	180	-3	Base Velocity: 16 level/0.27 nm
V	27	1	1	180	-4	Base Velocity: 16 level/0.54 nm
SW	28	1	1	180	-1	Base Spectrum Width: 8 level/0.13 nm
SW	29	1	1	180	-3	Base Spectrum Width: 8 level/0.27 nm
SW	30	1	1	180	-4	Base Spectrum Width: 8 level/0.54 nm
USP	31	1	1	180		User Selectable Storm Total Precipitation: 16 level/1.1 nm
DHR	32	1	1	60		Digital Hybrid Scan Reflectivity: 256 level/0.54 nm
HSR	33	1	1	180		Scan Reflectivity: 16 level/0.54 nm
CFC	34	1	1	360		Clutter Filter Control: 8 level/0.54 nm

This product has no extra parameters

Figure 5-1. RPG Product Generation Table Editor - Current

### 5.1.2 Precip Mode A Generation List

Click on the Precip (A) Table option and the window changes to the RPG Product Generation Table Editor (Precipitation Mode). It is password protected at the ROC level. See Figures [5-2](#) through [5-6](#).

This list specifies, as a minimum, the product generation and storage requirements. This list is password protected at the ROC level and cannot be modified at the user site. This list will automatically be invoked upon RPG restart or weather mode change from Clear Air Mode (B) to Precipitation Mode (A). Additional products may be added for generation and non-associated user distribution by the site adding to the Current generation list as a temporary addition, but the baseline listing remains under the ROC jurisdiction and control.

RPG Product Generation Table Editor

Close Save Undo Table: ☐ Current ☒ Precip (A) ☐ Clear Air (B) ☐ Maintenance

Baseline: Restore Update

Search:  Sort by: ☐ Product Code ☐ Product MNE ☐ Description

MNE	Code	Gen	Sto	(mins)	Elev/Cut(s)	Product Description
R	16	0	0	0	0	Base Reflectivity: 8 level/0.54 nm
R	17	0	0	0	0	Base Reflectivity: 8 level/1.1 nm
R	18	0	0	0	0	Base Reflectivity: 8 level/2.2 nm
R	19	1	1	180	-4	Base Reflectivity: 16 level/0.54 nm
R	20	1	1	180	-3	Base Reflectivity: 16 level/1.1 nm
R	21	0	0	0	0	Base Reflectivity: 16 level/2.2 nm
V	22	0	0	0	0	Base Velocity: 8 level/0.13 nm
V	23	0	0	0	0	Base Velocity: 8 level/0.27 nm
V	24	1	1	180	-1	Base Velocity: 8 level/0.54 nm
V	25	1	1	180	-1	Base Velocity: 16 level/0.13 nm
V	26	0	0	0	0	Base Velocity: 16 level/0.27 nm
V	27	1	1	180	-4	Base Velocity: 16 level/0.54 nm
SW	28	1	1	180	-1	Base Spectrum Width: 8 level/0.13 nm
SW	29	0	0	0	0	Base Spectrum Width: 8 level/0.27 nm
SW	30	1	1	180	-4	Base Spectrum Width: 8 level/0.54 nm
USP	31	1	1	180	0	User Selectable Storm Total Precipitation: 16 level/1.1 nm
DHR	32	1	1	60	0	Digital Hybrid Scan Reflectivity: 256 level/0.54 nm
HSR	33	1	1	180	0	Scan Reflectivity: 16 level/0.54 nm
CFC	34	1	1	360	0	Clutter Filter Control: 8 level/0.54 nm

This product has no extra parameters

Figure 5-2. RPG Product Generation Table Editor - Precip (A) (Products 16-34)

RPG Product Generation Table Editor

Close Save Undo Table: ☒ Precip (A) ☐ Clear Air (B) ☐ Maintenance

Baseline: Restore Update

Search:  Sort by: ☐ Product Code ☐ Product MNE ☐ Description

MNE	Code	Gen	Sto	(mins)	Elev/Cut(s)	Product Description
CR	35	0	0	0	<=	Composite Reflectivity: 8 level/0.54 nm
CR	36	0	0	0	<=	Composite Reflectivity: 8 level/2.2 nm
CR	37	1	1	180	<=	Composite Reflectivity: 16 level/0.54 nm
CR	38	1	1	180	<=	Composite Reflectivity: 16 level/2.2 nm
ET	41	1	1	180	<=	Echo Tops: 16 level/2.2 nm
SMR	43	0	0	0	<=	Severe Weather (Reflectivity): 16 level/0.54 nm
SWV	44	0	0	0	<=	Severe Weather (Velocity): 16 level/0.13 nm
SWW	45	0	0	0	<=	Severe Weather (Spectrum Width): 16 level/0.13 nm
SWS	46	0	0	0	<=	Severe Weather (Shear): 16 level/0.27 nm
SWP	47	1	1	180	<=	Severe Weather Probability: 4 level/2.2 nm
VMP	48	1	1	180	<=	VAD Wind Profile
RCS	50	0	0	0	<=	Cross Section (Reflectivity): 16 level/0.54 x 0.27 nm
VCS	51	0	0	0	<=	Cross Section (Velocity): 16 level/0.54 x 0.27 nm
SRR	55	0	0	0	<=	Storm Relative Velocity (Region): 16 level/0.27 nm
SRM	56	1	1	180	<=	Storm Relative Velocity (Map): 16 level/0.54 nm
VIL	57	1	1	180	<=	Vertically Integrated Liquid: 16 level/2.2 nm
STI	58	1	1	180	<=	Storm Tracking Information
HI	59	1	1	180	<=	Hail Index
M	60	1	1	180	<=	Mesocyclone

This product has no extra parameters

Figure 5-3. RPG Product Generation Table Editor - Precip (A) (Products 35-60)

RPG Product Generation Table Editor

Close Save Undo Table: ☒ Precip (A) ☐ Clear Air (B) ☐ Maintenance

Baseline: Restore Update

Search: Sort by: ☐ Product Code ☐ Product MNE ☐ Description

MNE	Code	Gen	Sto	(mins)	Elev/Cut(s)	Product Description
TVS	61	1	1	180	<=	Tornado Vortex Signature
SS	62	1	1	180	<=	Storm Structure
LRA	63	0	0	0	<=	Layer Composite Reflectivity (Layer 1 Average)
LRA	64	0	0	0	<=	Layer Composite Reflectivity (Layer 2 Average)
LRM	65	1	1	180	<=	Layer Composite Reflectivity (Layer 1 Maximum)
LRM	66	1	1	180	<=	Layer Composite Reflectivity (Layer 2 Maximum)
APR	67	1	1	180	<=	Layer Composite Reflectivity - AP Removed: 8 level/2.2 mm
UAM	73	0	0	0	<=	User Alert Message
RCM	74	1	1	180	<=	Radar Coded Message
FTM	75	0	0	0	<=	Free Text Message
OHP	78	1	1	180	<=	Surface Rainfall Accumulation (1 hr): 16 level/1.1 mm
THP	79	1	1	180	<=	Surface Rainfall Accumulation (3 hr): 16 level/1.1 mm
STP	80	1	1	180	<=	Storm Total Rainfall Accumulation: 16 level/1.1 mm
DPA	81	1	1	180	<=	Hourly Digital Precip Array: 256 level
SPD	82	1	1	180	<=	Supplemental Precipitation Data
VAD	84	0	0	0	<=	Velocity Azimuth Display: 8 level/5 kts
RCS	85	0	0	0	<=	Cross Section (Reflectivity): 8 level/0.54 x 0.27 mm
VCS	86	0	0	0	<=	Cross Section (Velocity): 8 level/0.54 x 0.27 mm
CS	87	0	0	0	<=	Combined Shear: 16 level

This product has no extra parameters

Figure 5-4. RPG Product Generation Table Editor - Precip (A) (Products 61-87)



RPG Product Generation Table Editor

Table: ☐ Current ☒ Precip (A) ☐ Clear Air (B) ☐ Maintenance

Baseline:

Search:

Sort by: ☒ Product Code ☐ Product MNE ☐ Description

MNE	Code	Gen	Sto	(mins)	Elev/Cut(s)	Product Description
LRA	89	0	0	0	<=	Layer Composite Reflectivity (Layer 3 Average): 8 level/2.2 nm
LRM	90	1	1	180	<=	Layer Composite Reflectivity (Layer 3 Maximum): 8 level/2.2 nm
DBV	93	0	0	0	<=	ITWS Digital Velocity Product: 256 level/0.54 nm
DR	94	0	0	0	<=	Base Reflectivity Data Array Product: 256 level/0.54 nm
CRE	95	0	0	0	<=	Composite Reflectivity Edited for AP: 8 level/0.54 nm
CRE	96	0	0	0	<=	Composite Reflectivity Edited for AP: 8 level/2.2 nm
CRE	97	0	0	0	<=	Composite Reflectivity Edited for AP: 16 level/0.54 nm
CRE	98	0	0	0	<=	Composite Reflectivity Edited for AP: 16 level/2.2 nm
DV	99	0	0	0	<=	Base Velocity Data Array Product: 256 level/0.13 nm
CLR	132	1	1	180	<=	Clutter Likelihood Reflectivity: 11 level/0.54 nm
CLD	133	1	1	180	<=	Clutter Likelihood Doppler: 12 level/0.54 nm
DVL	134	0	0	0	<=	High Resolution Digital VIL: 256 level/0.54 nm
EET	135	1	1	180	<=	Enhanced Echo Tops: 71 level/0.54 nm
SO	136	1	1	180	<=	Superob: NCEP Winds Model Initialization
ULR	137	0	0	0	<=	User Selectable Layer Composite Reflectivity (Maximum)
DSP	138	1	1	180	<=	Digital Storm Total Rainfall Accumulation: 256 level/1.1 nm
MRU	139	1	1	180	<=	Mesocyclone Rapid Update
MD	141	1	1	180	<=	Mesocyclone Detection Product
TRU	143	1	1	180	<=	Tornado Detection Rapid Update Product

This product has no extra parameters

Figure 5-5. RPG Product Generation Table Editor - Precip (A) (Products 89-143)

RPG Product Generation Table Editor

Close Save Undo Table: ☐ Current ☒ Precip (A) ☐ Clear Air (B) ☐ Maintenance

Baseline: Restore Update

Search:  Sort by: ☐ Product Code ☐ Product MNE ☐ Description

MNE	Code	Gen	Sto	(mins)	Elev/Cut(s)	Product Description
CLR	132	1	1	180	<=	-1 Clutter Likelihood Reflectivity: 11 level/0.54 mm
CLD	133	1	1	180	<=	-1 Clutter Likelihood Doppler: 12 level/0.54 mm
DVL	134	0	0	0	<=	High Resolution Digital VIL: 256 level/0.54 mm
EET	135	1	1	180	<=	Enhanced Echo Tops: 71 level/0.54 mm
SO	136	1	1	180	<=	Superob: NCEP Winds Model Initialization
ULR	137	0	0	0	<=	User Selectable Layer Composite Reflectivity (Maximum)
DSP	138	1	1	180	<=	Digital Storm Total Rainfall Accumulation: 256 level/1.1 mm
MRU	139	1	1	180	<=	Mesocyclone Rapid Update
MD	141	1	1	180	<=	Mesocyclone Detection Product
TRU	143	1	1	180	<=	45.0 Tornado Detection Rapid Update Product
OSW	144	0	0	0	<=	One-hour Snow Accumulation (Water Equiv.): 16 level/0.54 mm
OSD	145	0	0	0	<=	One-hour Snow Accumulation (Depth): 16 level/0.54 mm
SSW	146	0	0	0	<=	Storm Total Snow Accumulation (Water Equiv.): 16 level/0.54 mm
SSD	147	0	0	0	<=	Storm Total Snow Accumulation (Depth): 16 level/0.54 mm
DMD	149	0	0	0	<=	Mesocyclone Detection Data Array Product
USW	150	0	0	0	<=	User Selectable Snow Accumulation (Water Equiv.): 16 level/0.54
USD	151	0	0	0	<=	User Selectable Snow Accumulation (Depth): 16 level/0.54 mm

This product has no extra parameters

Figure 5-6. RPG Product Generation Table Editor - Precip (A) (Products 132-151)

### 5.1.2.1 Extra Parameters for Selected Products - Precip Mode

The extra parameters as shown in each figure (Figures 5-7 through 5-21) are associated with their respective products. They automatically appear in the bottom of the RPG Product Generation Table Editor when the product is selected and the generation value is set to 1.

Use the below form to edit product parameters (if applicable).

1

SWR	43	0	0	0	0	Severe Weather (Reflectivity): 16 level/0.54 mm
Use the below form to edit product parameters (if applicable).						
Description		Minimum	Maximum	Units		
Azimuth		0.0	359.9	Degrees		
Range		0.0	124.0	Mmiles		

Figure 5-8. Severe Weather (Reflectivity) - SWR 43

SWV	44	0	0	0	0	Severe Weather (Velocity): 16 level/0.13 mm
Use the below form to edit product parameters (if applicable).						
Description		Minimum	Maximum	Units		
Azimuth		0.0	359.9	Degrees		
Range		0.0	124.0	Miles		

Figure 5-9. Severe Weather (Velocity) - SWV 44

SWW	45	0	0	0	0	0	Severe Weather (Spectrum Width): 16 level/0.13 mm
Use the below form to edit product parameters (if applicable).							
Description		Minimum	Maximum	Units			
Azimuth		0.0	359.9	Degrees			
Range		0.0	124.0	Nmi les			

Figure 5-10. Severe Weather (Spectrum Width) - SWW 45

SWS460000

Severe Weather (Shear): 16 level/0.27 nm

Use the below form to edit product parameters (if applicable).

Description	Minimum	Maximum	Units
Azimuth	0.0	359.9	Degrees
Range	0.0	124.0	Nmiles

Figure 5-11. Severe Weather (Shear) - SWS 46



**CRCS**    **50**    **0**    **0**    **0**    **0**    **Cross Section (Reflectivity): 16 level/0.54 x 0.27 nm**

Use the below form to edit product parameters (if applicable).

Description	Minimum	Maximum	Units
Azimuth Point 1	0.0	359.9	Degrees
Range Point 1	0.0	124.0	Nmiles
Azimuth Point 2	0.0	359.9	Degrees
Range Point 2	0.0	124.0	Nmiles

Figure 5-12. Cross Section (Reflectivity) - RCS 50

VCS	51	0	0	0	0	Cross Section (Velocity): 16 level/0.54 x 0.27 nm
Use the below form to edit product parameters (if applicable).						
Description		Minimum	Maximum	Units		
Azimuth Point 1		0.0	359.9	Degrees		
Range Point 1		0.0	124.0	Nmiles		
Azimuth Point 2		0.0	359.9	Degrees		
Range Point 2		0.0	124.0	Nmiles		

Figure 5-13. Cross Section (Velocity) - VCS 51

SRR	55	0	0	0	0	0	0	Storm Relative Velocity (Region): 16 level/0.27 nm
-----	----	---	---	---	---	---	---	--

Use the below form to edit product parameters (if applicable).

Description	Minimum	Maximum	Units
Azimuth	0.0	359.9	Degrees
Range	0.0	124.0	Nmiles
Storm Speed	-1.0	99.9	Knots
Storm Direction	-1.0	359.9	Degrees

Figure 5-14. Storm Relative Velocity (Region) - SRR 55

Use the below form to edit product parameters (if applicable).

1

VAD	84	0	0	0	0	0	Velocity Azimuth Display: 8 level/5 kts								
<p>Use the below form to edit product parameters (if applicable).</p> <table border="1"> <tr> <td>Description</td> <td>Minimum</td> <td>Maximum</td> <td>Units</td> </tr> <tr> <td>Altitude</td> <td>0</td> <td>70</td> <td>kft</td> </tr> </table>								Description	Minimum	Maximum	Units	Altitude	0	70	kft
Description	Minimum	Maximum	Units												
Altitude	0	70	kft												

Figure 5-16. Velocity Azimuth Display - VAD 84

RCS850000

Cross Section (Reflectivity): 8 level/0.54 x 0.27 nm

Use the below form to edit product parameters (if applicable).

Description	Minimum	Maximum	Units
Azimuth Point 1	0.0	359.9	Degrees
Range Point 1	0.0	124.0	Nmiles
Azimuth Point 2	0.0	359.9	Degrees
Range Point 2	0.0	124.0	Nmiles

Figure 5-17. Cross Section (Reflectivity) - RCS 85

VCS	86	0	0	0	0	0	0	Cross Section (Velocity): 8 level/0.54 x 0.27 mm
-----	----	---	---	---	---	---	---	--

Use the below form to edit product parameters (if applicable).

Description	Minimum	Maximum	Units
Azimuth Point 1	0.0	359.9	Degrees
Range Point 1	0.0	124.0	Nmiles
Azimuth Point 2	0.0	359.9	Degrees
Range Point 2	0.0	124.0	Nmiles

Figure 5-18. Cross Section (Velocity) - VCS 86

Use the below form to edit product parameters (if applicable).

1



USW	150	0	0	0	0	0		User Selectable Snow Accumulation (Water Equiv.): 16 level/0.54
Use the below form to edit product parameters (if applicable).								
Description		Minimum	Maximum			Units		
End Hour		-1	23			Hours		
Time Duration		1	30			Hours		

Figure 5-20. User Selectable Snow Accumulation (Water Equiv.) - USW 150

[illegible]

1

### 5.1.3 Clear Air Mode B Generation List

Click on the Clear Air (B) Table option and the window changes to the RPG Product Generation Table Editor (Clear Air Mode). It is password protected at the ROC level. See Figures [5-22](#) through [5-26](#).

This list specifies, as a minimum, the product generation and storage requirements. This list is password protected at the ROC level and cannot be modified at the user site. This list will automatically be invoked upon RPG restart or weather mode change from Precipitation Mode (A) to Clear Air Mode (B). Additional products may be added for generation and non-associated user distribution by the site adding to the Current generation list as a temporary addition, but the baseline listing remains under the ROC jurisdiction and control.

RPG Product Generation Table Editor

Close Save Undo Table: ☐ Current ☐ Precip (A) ☒ Clear Air (B) ☐ Maintenance

Baseline: Restore Update

Search: Sort by: ☐ Product Code ☐ Product MNE ☐ Description

MNE	Code	Gen	Sto	(mins)	Elev/Cut(s)	Product Description
R 16	0	0	0	0	0	Base Reflectivity: 8 level/0.54 nm
R 17	0	0	0	0	0	Base Reflectivity: 8 level/1.1 nm
R 18	1	1	1	180	-1	Base Reflectivity: 8 level/2.2 nm
R 19	1	1	1	180	-4	Base Reflectivity: 16 level/0.54 nm
R 20	1	1	1	180	-3	Base Reflectivity: 16 level/1.1 nm
R 21	0	0	0	0	0	Base Reflectivity: 16 level/2.2 nm
V 22	0	0	0	0	0	Base Velocity: 8 level/0.13 nm
V 23	0	0	0	0	0	Base Velocity: 8 level/0.27 nm
V 24	1	1	1	180	-1	Base Velocity: 8 level/0.54 nm
V 25	1	1	1	180	-1	Base Velocity: 16 level/0.13 nm
V 26	1	1	1	180	-3	Base Velocity: 16 level/0.27 nm
V 27	1	1	1	180	-4	Base Velocity: 16 level/0.54 nm
SW 28	1	1	1	180	-1	Base Spectrum Width: 8 level/0.13 nm
SW 29	1	1	1	180	-3	Base Spectrum Width: 8 level/0.27 nm
SW 30	1	1	1	180	-4	Base Spectrum Width: 8 level/0.54 nm
USP 31	1	1	1	180		User Selectable Storm Total Precipitation: 16 level/1.1 nm
DHR 32	1	1	1	60		Digital Hybrid Scan Reflectivity: 256 level/0.54 nm
HSR 33	1	1	1	180		Scan Reflectivity: 16 level/0.54 nm
CFC 34	1	1	1	360		Clutter Filter Control: 8 level/0.54 nm

This product has no extra parameters

Figure 5-22. RPG Product Generation Table Editor - Clear Air (B) (Products 16-34)

RPG Product Generation Table Editor

Close Save Undo Table: ☐ Current ☐ Precip (A) ☒ Clear Air (B) ☐ Maintenance

Baseline: Restore Update

Search: Sort by: ☒ Product Code ☐ Product MNE ☐ Description

MNE	Code	Gen	Sto	(mins)	Elev/Cut(s)	Product Description
CR	35	0	0	0	<=	Composite Reflectivity: 8 level/0.54 nm
CR	36	1	1	180	<=	Composite Reflectivity: 8 level/2.2 nm
CR	37	1	1	180	<=	Composite Reflectivity: 16 level/0.54 nm
CR	38	1	1	180	<=	Composite Reflectivity: 16 level/2.2 nm
ET	41	0	0	0	<=	Echo Tops: 16 level/2.2 nm
SWR	43	0	0	0	<=	Severe Weather (Reflectivity): 16 level/0.54 nm
SWV	44	0	0	0	<=	Severe Weather (Velocity): 16 level/0.13 nm
SWW	45	0	0	0	<=	Severe Weather (Spectrum Width): 16 level/0.13 nm
SWS	46	0	0	0	<=	Severe Weather (Shear): 16 level/0.27 nm
SWP	47	0	0	0	<=	Severe Weather Probability: 4 level/2.2 nm
VMP	48	1	1	180	<=	VAD Wind Profile
RCS	50	0	0	0	<=	Cross Section (Reflectivity): 16 level/0.54 x 0.27 nm
VCS	51	0	0	0	<=	Cross Section (Velocity): 16 level/0.54 x 0.27 nm
SRR	55	0	0	0	<=	Storm Relative Velocity (Region): 16 level/0.27 nm
SRM	56	0	0	0	<=	Storm Relative Velocity (Map): 16 level/0.54 nm
VIL	57	0	0	0	<=	Vertically Integrated Liquid: 16 level/2.2 nm
STI	58	0	0	0	<=	Storm Tracking Information
HI	59	0	0	0	<=	Hail Index
M	60	0	0	0	<=	Mesocyclone

This product has no extra parameters

Figure 5-23. RPG Product Generation Table Editor - Clear Air (B) (Products 35-60)

RPG Product Generation Table Editor

Close Save Undo Update

Table: ☐ Current ☐ Precip (A) ☐ Clear Air (B) ☐ Maintenance

Baseline: Restore Update

Search:

Sort by: ☐ Product Code ☐ Product MNE ☐ Description

MNE	Code	Gen	Sto	(mins)	Elev/Cut(s)	Product Description
TVS	61	0	0	0	<=	Tornado Vortex Signature
SS	62	0	0	0	<=	Storm Structure
LRA	63	0	0	0	<=	Layer Composite Reflectivity (Layer 1 Average)
LRA	64	0	0	0	<=	Layer Composite Reflectivity (Layer 2 Average)
LRM	65	1	1	180	<=	Layer Composite Reflectivity (Layer 1 Maximum)
LRM	66	0	0	0	<=	Layer Composite Reflectivity (Layer 2 Maximum)
APR	67	1	1	180	<=	Layer Composite Reflectivity - AP Removed: 8 level/2.2 nm
UAM	73	0	0	0	<=	User Alert Message
RCM	74	1	1	180	<=	Radar Coded Message
FTM	75	0	0	0	<=	Free Text Message
OHP	78	1	1	180	<=	Surface Rainfall Accumulation (1 hr): 16 level/1.1 nm
THP	79	1	1	180	<=	Surface Rainfall Accumulation (3 hr): 16 level/1.1 nm
STP	80	1	1	180	<=	Storm Total Rainfall Accumulation: 16 level/1.1 nm
DPA	81	1	1	180	<=	Hourly Digital Precip Array: 256 level
SPD	82	1	1	180	<=	Supplemental Precipitation Data
VAD	84	0	0	0	<=	Velocity Azimuth Display: 8 level/5 kts
RCS	85	0	0	0	<=	Cross Section (Reflectivity): 8 level/0.54 x 0.27 nm
VCS	86	0	0	0	<=	Cross Section (Velocity): 8 level/0.54 x 0.27 nm
CS	87	0	0	0	<=	Combined Shear: 16 level

This product has no extra parameters

Figure 5-24. RPG Product Generation Table Editor - Clear Air (B) (Products 61-87)

RPG Product Generation Table Editor

Table: ☐ Current ☐ Precip (A) ☐ Clear Air (B) ☐ Maintenance

Baseline:

Search:

Sort by: ☒ Product Code ☐ Product MNE ☐ Description

MNE	Code	Gen	Sto	(mins)	Elev/Cut(s)	Product Description
LRA	89	0	0	0	<=	Layer Composite Reflectivity (Layer 3 Average): 8 level/2.2 nm
LRM	90	0	0	0	<=	Layer Composite Reflectivity (Layer 3 Maximum): 8 level/2.2 nm
DBV	93	0	0	0	<=	ITWS Digital Velocity Product: 256 level/0.54 nm
DR	94	0	0	0	<=	Base Reflectivity Data Array Product: 256 level/0.54 nm
CRE	95	0	0	0	<=	Composite Reflectivity Edited for AP: 8 level/0.54 nm
CRE	96	0	0	0	<=	Composite Reflectivity Edited for AP: 8 level/2.2 nm
CRE	97	0	0	0	<=	Composite Reflectivity Edited for AP: 16 level/0.54 nm
CRE	98	0	0	0	<=	Composite Reflectivity Edited for AP: 16 level/2.2 nm
DV	99	0	0	0	<=	Base Velocity Data Array Product: 256 level/0.13 nm
CLR	132	1	1	180	<=	Clutter Likelihood Reflectivity: 11 level/0.54 nm
CLD	133	1	1	180	<=	Clutter Likelihood Doppler: 12 level/0.54 nm
DVL	134	0	0	0	<=	High Resolution Digital VIL: 256 level/0.54 nm
EET	135	1	1	180	<=	Enhanced Echo Tops: 71 level/0.54 nm
SO	136	1	1	180	<=	Superob: NCEP Winds Model Initialization
ULR	137	0	0	0	<=	User Selectable Layer Composite Reflectivity (Maximum)
DSP	138	0	0	0	<=	Digital Storm Total Rainfall Accumulation: 256 level/1.1 nm
MRU	139	0	0	0	<=	Mesocyclone Rapid Update
MD	141	1	1	180	<=	Mesocyclone Detection Product
TRU	143	0	0	0	<=	Tornado Detection Rapid Update Product

This product has no extra parameters

Figure 5-25. RPG Product Generation Table Editor - Clear Air (B) (Products 89-143)

RPG Product Generation Table Editor

Close Save Undo Table: ☐ Current ☐ Precip (A) ☒ Clear Air (B) ☐ Maintenance

Baseline: Restore Update

Search: Sort by: ☐ Product Code ☐ Product MNE ☐ Description

MNE	Code	Gen	Sto	(mins)	Elev/Cut(s)	Product Description
CLR	132	1	1	180	<=	-1 Clutter Likelihood Reflectivity: 11 level/0.54 mm
CLD	133	1	1	180	<=	-1 Clutter Likelihood Doppler: 12 level/0.54 mm
DVL	134	0	0	0	<=	High Resolution Digital VIL: 256 level/0.54 mm
EET	135	1	1	180	<=	Enhanced Echo Tops: 71 level/0.54 mm
SO	136	1	1	180	<=	Superob: NCEP Winds Model Initialization
ULR	137	0	0	0	<=	User Selectable Layer Composite Reflectivity (Maximum)
DSP	138	0	0	0	<=	Digital Storm Total Rainfall Accumulation: 256 level/1.1 mm
MRU	139	0	0	0	<=	Mesocyclone Rapid Update
MD	141	1	1	180	<=	Mesocyclone Detection Product
TRU	143	0	0	0	<=	Tornado Detection Rapid Update Product
OSW	144	0	0	0	<=	One-hour Snow Accumulation (Water Equiv.): 16 level/0.54 mm
OSD	145	0	0	0	<=	One-hour Snow Accumulation (Depth): 16 level/0.54 mm
SSW	146	0	0	0	<=	Storm Total Snow Accumulation (Water Equiv.): 16 level/0.54 mm
SSD	147	0	0	0	<=	Storm Total Snow Accumulation (Depth): 16 level/0.54 mm
DMD	149	0	0	0	<=	Mesocyclone Detection Data Array Product
USW	150	0	0	0	<=	User Selectable Snow Accumulation (Water Equiv.): 16 level/0.54
USD	151	0	0	0	<=	User Selectable Snow Accumulation (Depth): 16 level/0.54 mm

This product has no extra parameters

Figure 5-26. RPG Product Generation Table Editor - Clear Air (B) (Products 132-151)



### 5.1.3.1 Extra Parameters for Selected Products - Clear Air Mode

The extra parameters as shown in each figure (Figures 5-27 through 5-41) are associated with their respective products. They automatically appear in the bottom of the RPG Product Generation Table Editor when the product is selected and the generation value is set to 1.

USP 31 1 1 180 180 User Selectable Storm Total Precipitation: 16 level/1.1 mm

Use the below form to edit product parameters (if applicable).

Description	Minimum	Maximum	Units
End Hour	-1	23	Hours
Time Duration	1	24	Hours

Figure 5-27. User Selectable Storm Total Precip - USP 31

SWR	43	0	0	0	0	Severe Weather (Reflectivity): 16 level/0.54 nm
-----	----	---	---	---	---	---

Use the below form to edit product parameters (if applicable).

Description	Minimum	Maximum	Units
Azimuth	0.0	359.9	Degrees
Range	0.0	124.0	Nmiles

Figure 5-28. Severe Weather (Reflectivity) - SWR 43

SWV440000

Severe Weather (Velocity): 16 level/0.13 nm

Use the below form to edit product parameters (if applicable).

Description	Minimum	Maximum	Units
Azimuth	0.0	359.9	Degrees
Range	0.0	124.0	Nmiles

Figure 5-29. Severe Weather (Velocity) - SWV 44

SWW	45	0	0	0	0	0	Severe Weather (Spectrum Width): 16 level/0.13 nm
-----	----	---	---	---	---	---	---

Use the below form to edit product parameters (if applicable).

Description	Minimum	Maximum	Units
Azimuth	0.0	359.9	Degrees
Range	0.0	124.0	Nmiles

Figure 5-30. Severe Weather (Spectrum Width) - SWW 45

SWS460000

Severe Weather (Shear): 16 level/0.27 nm

Use the below form to edit product parameters (if applicable).

Description	Minimum	Maximum	Units
Azimuth	0.0	359.9	Degrees
Range	0.0	124.0	Nmiles


Figure 5-31. Severe Weather (Shear) - SWS 46

RCS	50	0	0	0	0	0	Cross Section (Reflectivity): 16 level/0.54 x 0.27 nm
-----	----	---	---	---	---	---	---

Use the below form to edit product parameters (if applicable).

Description	Minimum	Maximum	Units
Azimuth Point 1	0.0	359.9	Degrees
Range Point 1	0.0	124.0	Nmiles
Azimuth Point 2	0.0	359.9	Degrees
Range Point 2	0.0	124.0	Nmiles

Figure 5-32. Cross Section (Reflectivity) - RCS 50

VCS 51 0 0 0  Cross Section (Velocity): 16 level/0.54 x 0.27 nm

Use the below form to edit product parameters (if applicable).

Description	Minimum	Maximum	Units
Azimuth Point 1	0.0	359.9	Degrees
Range Point 1	0.0	124.0	Nmiles
Azimuth Point 2	0.0	359.9	Degrees
Range Point 2	0.0	124.0	Nmiles

Figure 5-33. Cross Section (Velocity) - VCS 51



SRR	55	0	0	0	0	0	Storm Relative Velocity (Region): 16 level/0.27 nm
-----	----	---	---	---	---	---	--

Use the below form to edit product parameters (if applicable).

Description	Minimum	Maximum	Units
Azimuth	0.0	359.9	Degrees
Range	0.0	124.0	Nmiles
Storm Speed	-1.0	99.9	Knots
Storm Direction	-1.0	359.9	Degrees

Figure 5-34. Storm Relative Velocity (Region) - SRR 55

SRM	56	0	0	0	0	0	Storm Relative Velocity (Map): 16 level/0.54 nm
Use the below form to edit product parameters (if applicable).							
Description	Minimum	Maximum					Units
Storm Speed	-1.0	99.9					Knots
Storm Direction	-1.0	359.9					Degrees

Figure 5-35. Storm Relative Velocity (Map) - SRM 56

VAD	84	0	0	0	0	Velocity Azimuth Display: 8 level/5 kts
Use the below form to edit product parameters (if applicable).						
Description		Minimum	Maximum	Units		
Altitude		0	70	kft		

Figure 5-36. Velocity Azimuth Display - VAD 84

RCS85000

Cross Section (Reflectivity): 8 level/0.54 x 0.27 nm

Use the below form to edit product parameters (if applicable).

Description	Minimum	Maximum	Units
Azimuth Point 1	0.0	359.9	Degrees
Range Point 1	0.0	124.0	Nmiles
Azimuth Point 2	0.0	359.9	Degrees
Range Point 2	0.0	124.0	Nmiles

Figure 5-37. Cross Section (Reflectivity) - RCS 85

VCS	86	0	0	0	0	Cross Section (Velocity): 8 level/0.54 x 0.27 nm
-----	----	---	---	---	---	--

Use the below form to edit product parameters (if applicable).

Description	Minimum	Maximum	Units
Azimuth Point 1	0.0	359.9	Degrees
Range Point 1	0.0	124.0	Nmiles
Azimuth Point 2	0.0	359.9	Degrees
Range Point 2	0.0	124.0	Nmiles

Figure 5-38. Crosection (Velocity) - VCS 86

ULR	137	0	0	0	0	0	User Selectable Layer Composite Reflectivity (Maximum)
-----	-----	---	---	---	---	---	--

Use the below form to edit product parameters (if applicable).

Description	Minimum	Maximum	Units
bottom boundary	0	69	kft
top boundary	1	70	kft

Figure 5-39. User Selectable Layer Composite Reflectivity (Maximum) - ULR 137

USW    150    0    0    0    <--->

User Selectable Snow Accumulation (Water Equiv.):

16 level/0.54

Use the below form to edit product parameters (if applicable).

Description	Minimum	Maximum	Units
End Hour	-1	23	Hours
Time Duration	1	30	Hours

Figure 5-40. User Selectable Snow Accumulation (Water Equiv.) - USW 150

USD151000<...>

User Selectable Snow Accumulation (Depth): 16 level/0.54 mm

Use the below form to edit product parameters (if applicable).

Description	Minimum	Maximum	Units
End Hour	-1	23	Hours
Time Duration	1	30	Hours

Figure 5-41. User Selectable Snow Accumulation (Depth) - USD 151



### 5.1.4 Maintenance Mode Generation List

Click on the Maintenance Table option and the window changes to the RPG Product Generation Table Editor Maintenance Mode and is password protected at the ROC level. See Figures [5-42](#) through [5-46](#). This mode is normally only used by the site technician when performing maintenance operations.

RPG Product Generation Table Editor

Table: ☐ Current ☐ Precip (A) ☐ Clear Air (B) ☒ Maintenance

Baseline:

Search:

Sort by: ☐ Product Code ☐ Product MNE ☐ Description

MNE	Code	Gen	Sto	(mins)	Elev/Cut(s)	Product Description
R	16	0	0	0	<=	Base Reflectivity: 8 level/0.54 mm
R	17	0	0	0	<=	Base Reflectivity: 8 level/1.1 mm
R	18	0	0	0	<=	Base Reflectivity: 8 level/2.2 mm
R	19	0	0	0	<=	Base Reflectivity: 16 level/0.54 mm
R	20	0	0	0	<=	Base Reflectivity: 16 level/1.1 mm
R	21	0	0	0	<=	Base Reflectivity: 16 level/2.2 mm
V	22	0	0	0	<=	Base Velocity: 8 level/0.13 mm
V	23	0	0	0	<=	Base Velocity: 8 level/0.27 mm
V	24	0	0	0	<=	Base Velocity: 8 level/0.54 mm
V	25	0	0	0	<=	Base Velocity: 16 level/0.13 mm
V	26	0	0	0	<=	Base Velocity: 16 level/0.27 mm
V	27	0	0	0	<=	Base Velocity: 16 level/0.54 mm
SW	28	0	0	0	<=	Base Spectrum Width: 8 level/0.13 mm
SW	29	0	0	0	<=	Base Spectrum Width: 8 level/0.27 mm
SW	30	0	0	0	<=	Base Spectrum Width: 8 level/0.54 mm
USP	31	0	0	0	<=	User Selectable Storm Total Precipitation: 16 level/1.1 mm
DHR	32	0	0	0	<=	Digital Hybrid Scan Reflectivity: 256 level/0.54 mm
HSR	33	0	0	0	<=	Scan Reflectivity: 16 level/0.54 mm
CFC	34	0	0	0	<=	Clutter Filter Control: 8 level/0.54 mm

This product has no extra parameters

Figure 5-42. RPG Product Generation Table Editor - Maintenance (Products 16-34)

RPG Product Generation Table Editor

Table: ☐ Current ☐ Precip (A) ☐ Clear Air (B) ☐ Maintenance

Search: 
 Sort by: ☒ Product Code ☐ Product MNE ☐ Description

MNE	Code	Gen	Sto	(mins)	Elev/Cut(s)	Product Description
CR	35	0	0	0	<=	Composite Reflectivity: 8 level/0.54 nm
CR	36	0	0	0	<=	Composite Reflectivity: 8 level/2.2 nm
CR	37	0	0	0	<=	Composite Reflectivity: 16 level/0.54 nm
CR	38	0	0	0	<=	Composite Reflectivity: 16 level/2.2 nm
ET	41	0	0	0	<=	Echo Tops: 16 level/2.2 nm
SWR	43	0	0	0	<=	Severe Weather (Reflectivity): 16 level/0.54 nm
SNV	44	0	0	0	<=	Severe Weather (Velocity): 16 level/0.13 nm
SNW	45	0	0	0	<=	Severe Weather (Spectrum Width): 16 level/0.13 nm
SWS	46	0	0	0	<=	Severe Weather (Shear): 16 level/0.27 nm
SNP	47	0	0	0	<=	Severe Weather Probability: 4 level/2.2 nm
VMP	48	0	0	0	<=	VAD Wind Profile
RCS	50	0	0	0	<=	Cross Section (Reflectivity): 16 level/0.54 x 0.27 nm
VCS	51	0	0	0	<=	Cross Section (Velocity): 16 level/0.54 x 0.27 nm
SRR	55	0	0	0	<=	Storm Relative Velocity (Region): 16 level/0.27 nm
SRM	56	0	0	0	<=	Storm Relative Velocity (Map): 16 level/0.54 nm
VIL	57	0	0	0	<=	Vertically Integrated Liquid: 16 level/2.2 nm
STI	58	0	0	0	<=	Storm Tracking Information
HI	59	0	0	0	<=	Hail Index
M	60	0	0	0	<=	Mesocyclone

This product has no extra parameters

Figure 5-43. RPG Product Generation Table Editor - Maintenance (Products 35-60)

RPG Product Generation Table Editor

Close Save Undo Table: ☐ Current ☐ Precip (A) ☐ Clear Air (B) ☒ Maintenance

Baseline: Restore Update

Search:  Sort by: ☐ Product Code ☐ Product MNE ☐ Description

MNE	Code	Gen	Sto	(mins)	Elev/Cut(s)	Product Description
TVS	61	0	0	0	<=	Tornado Vortex Signature
SS	62	0	0	0	<=	Storm Structure
LRA	63	0	0	0	<=	Layer Composite Reflectivity (Layer 1 Average)
LRA	64	0	0	0	<=	Layer Composite Reflectivity (Layer 2 Average)
LRM	65	0	0	0	<=	Layer Composite Reflectivity (Layer 1 Maximum)
LRM	66	0	0	0	<=	Layer Composite Reflectivity (Layer 2 Maximum)
APR	67	0	0	0	<=	Layer Composite Reflectivity - AP Removed: 8 level/2.2 nm
UAM	73	0	0	0	<=	User Alert Message
RCM	74	0	0	0	<=	Radar Coded Message
FTM	75	0	0	0	<=	Free Text Message
OHP	78	0	0	0	<=	Surface Rainfall Accumulation (1 hr): 16 level/1.1 nm
THP	79	0	0	0	<=	Surface Rainfall Accumulation (3 hr): 16 level/1.1 nm
STP	80	0	0	0	<=	Storm Total Rainfall Accumulation: 16 level/1.1 nm
DPA	81	0	0	0	<=	Hourly Digital Precip Array: 256 level
SPD	82	0	0	0	<=	Supplemental Precipitation Data
VAD	84	0	0	0	<=	Velocity Azimuth Display: 8 level/5 kts
RCS	85	0	0	0	<=	Cross Section (Reflectivity): 8 level/0.54 x 0.27 nm
VCS	86	0	0	0	<=	Cross Section (Velocity): 8 level/0.54 x 0.27 nm
CS	87	0	0	0	<=	Combined Shear: 16 level

This product has no extra parameters

Figure 5-44. RPG Product Generation Table Editor - Maintenance  
(Products 61-87)

RPG Product Generation Table Editor

Close Save Undo Table: ☐ Current ☐ Precip (A) ☐ Clear Air (B) ☒ Maintenance

Baseline: Restore Update

Search:  Sort by: ☒ Product Code ☐ Product MNE ☐ Description

MNE	Code	Gen	Sto	(mins)	Elev/Cut(s)	Product Description
LRA	89	0	0	0	<=	Layer Composite Reflectivity (Layer 3 Average): 8 level/2.2 nm
LRM	90	0	0	0	<=	Layer Composite Reflectivity (Layer 3 Maximum): 8 level/2.2 nm
DBV	93	0	0	0	<=	ITWS Digital Velocity Product: 256 level/0.54 nm
DR	94	0	0	0	<=	Base Reflectivity Data Array Product: 256 level/0.54 nm
CRE	95	0	0	0	<=	Composite Reflectivity Edited for AP: 8 level/0.54 nm
CRE	96	0	0	0	<=	Composite Reflectivity Edited for AP: 8 level/2.2 nm
CRE	97	0	0	0	<=	Composite Reflectivity Edited for AP: 16 level/0.54 nm
CRE	98	0	0	0	<=	Composite Reflectivity Edited for AP: 16 level/2.2 nm
DV	99	0	0	0	<=	Base Velocity Data Array Product: 256 level/0.13 nm
CLR	132	0	0	0	<=	Clutter Likelihood Reflectivity: 11 level/0.54 nm
CLD	133	0	0	0	<=	Clutter Likelihood Doppler: 12 level/0.54 nm
DVL	134	0	0	0	<=	High Resolution Digital VIL: 256 level/0.54 nm
EET	135	0	0	0	<=	Enhanced Echo Tops: 71 level/0.54 nm
SO	136	0	0	0	<=	Superob: NCEP Winds Model Initialization
ULR	137	0	0	0	<=	User Selectable Layer Composite Reflectivity (Maximum)
DSP	138	0	0	0	<=	Digital Storm Total Rainfall Accumulation: 256 level/1.1 nm
MRU	139	0	0	0	<=	Mesocyclone Rapid Update
MD	141	0	0	0	<=	Mesocyclone Detection Product
TRU	143	0	0	0	<=	Tornado Detection Rapid Update Product

This product has no extra parameters

Figure 5-45. RPG Product Generation Table Editor - Maintenance  
(Products 89-143)

RPG Product Generation Table Editor

Close Save Undo Table: ☐ Current ☐ Precip (A) ☐ Clear Air (B) ☐ Maintenance

Baseline: Restore Update

Search: Sort by: ☐ Product Code ☐ Product MNE ☐ Description

MNE	Code	Gen	Sto	(mins)	Elev/Cut(s)	Product Description
CLR	132	0	0	0	<=	Clutter Likelihood Reflectivity: 11 level/0.54 nm
CLD	133	0	0	0	<=	Clutter Likelihood Doppler: 12 level/0.54 nm
DVL	134	0	0	0	<=	High Resolution Digital VIL: 256 level/0.54 nm
EET	135	0	0	0	<=	Enhanced Echo Tops: 71 level/0.54 nm
SO	136	0	0	0	<=	Superob: NCEP Winds Model Initialization
ULR	137	0	0	0	<=	User Selectable Layer Composite Reflectivity (Maximum)
DSP	138	0	0	0	<=	Digital Storm Total Rainfall Accumulation: 256 level/1.1 nm
MRU	139	0	0	0	<=	Mesocyclone Rapid Update
MD	141	0	0	0	<=	Mesocyclone Detection Product
TRU	143	0	0	0	<=	Tornado Detection Rapid Update Product
OSW	144	0	0	0	<=	One-hour Snow Accumulation (Water Equiv.): 16 level/0.54 nm
OSD	145	0	0	0	<=	One-hour Snow Accumulation (Depth): 16 level/0.54 nm
SSW	146	0	0	0	<=	Storm Total Snow Accumulation (Water Equiv.): 16 level/0.54 nm
SSD	147	0	0	0	<=	Storm Total Snow Accumulation (Depth): 16 level/0.54 nm
PMU	149	0	0	0	<=	Mesocyclone Detection Data Array Product
USW	150	0	0	0	<=	User Selectable Snow Accumulation (Water Equiv.): 16 level/0.54
USD	151	0	0	0	<=	User Selectable Snow Accumulation (Depth): 16 level/0.54 nm

This product has no extra parameters

Figure 5-46. RPG Product Generation Table Editor - Maintenance (Products 132-151)

## Chapter 6

# RPG Products - Load Shed Products

---

### 6.1 Load Shed Products

When product load shedding occurs, the goal is to ensure that products critical to the decision making process continue to be available at the expense of lower priority products. This RPG Product Priority (Load Shed Products) window (Figures 6-1 through 6-5) sets the relative product priorities (the higher the number, the higher the priority). This is password protected at the ROC LOCA, but is viewable at each site.

RPG Product Priority (Load Shed Products)

Close Save Undo Baseline: Restore Update

Search:  Sort by: ☐ Product Code ☐ Product MNE ☐ Description

MNE	Code	Mode A	Mode B	Mode M	Product Description
R	16	56	56	56	Base Reflectivity: 8 level/0.54 nm
R	17	55	55	55	Base Reflectivity: 8 level/1.1 nm
R	18	54	54	54	Base Reflectivity: 8 level/2.2 nm
R	19	89	89	89	Base Reflectivity: 16 level/0.54 nm
R	20	88	88	88	Base Reflectivity: 16 level/1.1 nm
R	21	87	87	87	Base Reflectivity: 16 level/2.2 nm
V	22	53	53	53	Base Velocity: 8 level/0.13 nm
V	23	52	52	52	Base Velocity: 8 level/0.27 nm
V	24	51	51	51	Base Velocity: 8 level/0.54 nm
V	25	86	86	86	Base Velocity: 16 level/0.13 nm
V	26	85	85	85	Base Velocity: 16 level/0.27 nm
V	27	84	84	84	Base Velocity: 16 level/0.54 nm
SW	28	60	60	60	Base Spectrum Width: 8 level/0.13 nm
SW	29	59	59	59	Base Spectrum Width: 8 level/0.27 nm
SW	30	58	58	58	Base Spectrum Width: 8 level/0.54 nm
USP	31	57	57	57	User Selectable Storm Total Precipitation: 16 level/1.1 nm
DHR	32	57	57	57	Digital Hybrid Scan Reflectivity: 256 level/0.54 nm
HSR	33	57	57	57	Hybrid Scan Reflectivity: 16 level/0.54 nm
CFC	34	99	99	99	Clutter Filter Control: 8 level/0.54 nm

Figure 6-1. RPG Product Priority (Load Shed Products) (Products 16-34)



RPG Product Priority (Load Shed Products)

Close Save Undo Restore Update

Baseline: ☐ Product Code ☐ Product MNE ☐ Description

Sort by: ☐ Product Code ☐ Product MNE ☐ Description

Search:

MNE	Code	Mode A	Mode B	Mode M	Product Description
CR	35	48	48	48	Composite Reflectivity: 8 level/0.54 nm
CR	36	47	47	47	Composite Reflectivity: 8 level/2.2 nm
CR	37	76	76	76	Composite Reflectivity: 16 level/0.54 nm
CR	38	75	75	75	Composite Reflectivity: 16 level/2.2 nm
ET	41	66	66	66	Echo Tops: 16 level/2.2 nm
SWR	43	94	94	94	Severe Weather (Reflectivity): 16 level/0.54 nm
SWV	44	93	93	93	Severe Weather (Velocity): 16 level/0.13 nm
SWW	45	92	92	92	Severe Weather (Spectrum Width): 16 level/0.13 nm
SWS	46	46	46	46	Severe Weather (Shear): 16 level/0.27 nm
SWP	47	69	69	69	Severe Weather Probability: 4 level/2.2 nm
VWP	48	82	82	82	VAD Wind Profile
RCS	50	98	98	98	Cross Section (Reflectivity): 16 level/0.54 x 0.27 nm
VCS	51	97	97	97	Cross Section (Velocity): 16 level/0.54 x 0.27nm
SRR	55	67	67	67	Storm Relative Velocity (Region): 16 level/0.27 nm
SRM	56	68	68	68	Storm Relative Velocity (Map): 16 level/0.54 nm
VIL	57	83	83	83	Vertically Integrated Liquid: 16 level/2.2 nm
STI	58	74	74	74	Storm Tracking Information
HI	59	72	72	72	Hail Index
M	60	71	71	71	Mesocyclone

Figure 6-2. RPG Product Priority (Load Shed Products) (Products 35-60)

RPG Product Priority (Load Shed Products)

Close Save Undo Baseline: Restore Update

Search: Sort by: ☐ Product Code ☐ Product MNE ☐ Description

MNE	Code	Mode A	Mode B	Mode M	Product Description
TVS	61	70	70	70	Tornado Vortex Signature
SS	62	73	73	73	Storm Structure
LRA	63	42	42	42	Layer Composite Reflectivity (Layer 1 Average)
LRA	64	41	41	41	Layer Composite Reflectivity (Layer 2 Average)
LRM	65	63	63	63	Layer Composite Reflectivity (Layer 1 Maximum)
LRM	66	62	62	62	Layer Composite Reflectivity (Layer 2 Maximum)
APR	67	62	62	62	Layer Composite Reflectivity - AP Removed: 8 level/2.2 nm
UAM	73	255	255	255	User Alert Message
RCM	74	65	65	65	Radar Coded Message
FTM	75	90	90	90	Free Text Message
OHP	78	81	81	81	Surface Rainfall Accumulation (1 hr): 16 level/1.1 nm
THP	79	77	77	77	Surface Rainfall Accumulation (3 hr): 16 level/1.1 nm
STP	80	78	78	78	Storm Total Rainfall Accumulation: 16 level/1.1 nm
DPA	81	80	80	80	Hourly Digital Precip Array: 256 level
SPD	82	79	79	79	Supplemental Precipitation Data
VAD	84	57	57	57	Velocity Azimuth Display: 8 level/5 kts
RCS	85	50	50	50	Cross Section (Reflectivity): 8 level/0.54 x 0.27 nm
VCS	86	49	49	49	Cross Section (Velocity): 8 level/0.54 x 0.27 nm

Figure 6-3. RPG Product Priority (Load Shed Products) (Products 61-86)

RPG Product Priority (Load Shed Products)

Close Save Undo Baseline: Restore Update

Search: Sort by: ☐ Product Code ☐ Product MNE ☐ Description

MNE	Code	Mode A	Mode B	Mode M	Product Description
CS	87	39	39	39	Combined Shear: 16 level
LRA	89	40	40	40	Layer Composite Reflectivity (Layer 3 Average): 8 level/2.2 mm
LRM	90	61	61	61	Layer Composite Reflectivity (Layer 3 Maximum): 8 level/2.2 mm
DBV	93	37	37	37	ITWS Digital Velocity Product: 256 level/0.54 mm
DR	94	35	35	35	Base Reflectivity Data Array Product: 256 level/0.54 mm
CRE	95	35	35	35	Composite Reflectivity Edited for AP: 8 level/0.54 mm
CRE	96	33	33	33	Composite Reflectivity Edited for AP: 8 level/2.2 mm
CRE	97	36	36	36	Composite Reflectivity Edited for AP: 16 level/0.54 mm
CRE	98	34	34	34	Composite Reflectivity Edited for AP: 16 level/2.2 mm
DV	99	34	34	34	Base Velocity Data Array Product: 256 level/0.13 mm
CLR	132	70	70	70	Clutter Likelihood Reflectivity: 11 level/0.54 mm
CLD	133	70	70	70	Clutter Likelihood Doppler: 12 level/0.54 mm
DVL	134	80	80	80	High Resolution Digital VIL: 256 level/0.54 mm
EET	135	80	80	80	Enhanced Echo Tops: 71 level/0.54 mm
SO	136	89	89	89	Superob: NCEP Winds Model Initialization
ULR	137	65	65	65	User Selectable Layer Composite Reflectivity (Maximum)
DSP	138	80	80	80	Digital Storm Total Rainfall Accumulation: 256 level/1.1 mm

Figure 6-4. RPG Product Priority (Load Shed Products) (Products 87-138)

RPG Product Priority (Load Shed Products)

Close Save Undo Baseline: Restore Update

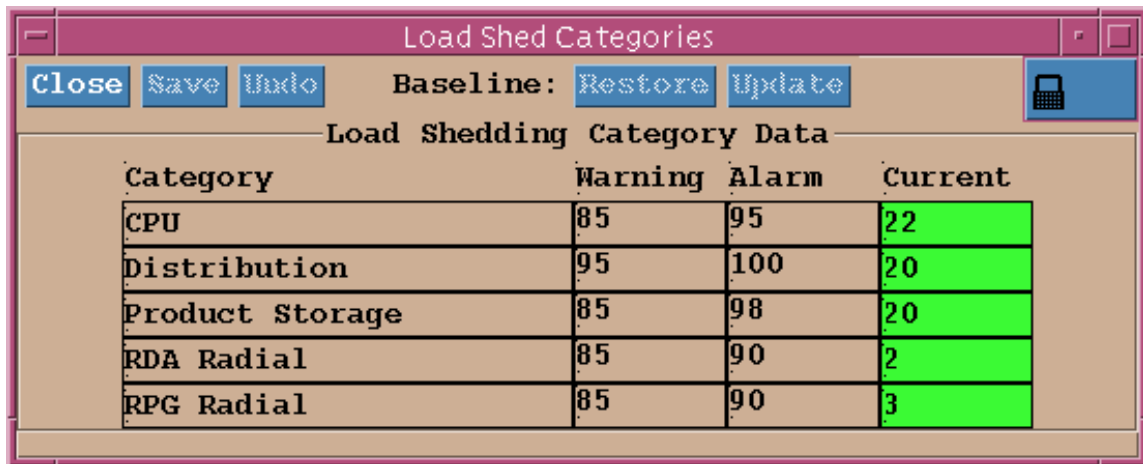
Search: Sort by: ☐ Product Code ☐ Product MNE ☐ Description

MNE	Code	Mode A	Mode B	Mode M	Product Description
CLR	132	70	70	70	Clutter Likelihood Reflectivity: 11 level/0.54 nm
CLD	133	70	70	70	Clutter Likelihood Doppler: 12 level/0.54 nm
DWL	134	80	80	80	High Resolution Digital VIL: 256 level/0.54 nm
EET	135	80	80	80	Enhanced Echo Tops: 71 level/0.54 nm
SO	136	89	89	89	Superob: NCEP Winds Model Initialization
ULR	137	65	65	65	User Selectable Layer Composite Reflectivity (Maximum)
DSP	138	80	80	80	Digital Storm Total Rainfall Accumulation: 256 level/1.1 nm
MRU	139	87	87	87	Mesocyclone Rapid Update
MD	141	87	87	87	Mesocyclone Detection Product
TRU	143	70	70	70	Tornado Detection Rapid Update Product
OSW	144	81	81	81	One-hour Snow Accumulation (Water Equiv.): 16 level/0.54 nm
OSD	145	77	77	77	One-hour Snow Accumulation (Depth): 16 level/0.54 nm
SSW	146	78	78	78	Storm Total Snow Accumulation (Water Equiv.): 16 level/0.54 nm
SSD	147	80	80	80	Storm Total Snow Accumulation (Depth): 16 level/0.54 nm
DMD	149	87	87	87	Mesocyclone Detection Data Array Product
USW	150	79	79	79	User Selectable Snow Accumulation (Water Equiv.): 16 level/0.54 nm
USD	151	79	79	79	User Selectable Snow Accumulation (Depth): 16 level/0.54 nm

Figure 6-5. RPG Product Priority (Load Shed Products) (Products 132-151)

## 6.2 Load Shed Categories

When any utilization level reaches its predetermined threshold, the RPG initiates automatic load control measures to ensure continued RPG operation. Click on the Load Shed: text line in the lower right hand corner of the RPG Control/Status window to select the Load Shed Categories window. See [Figure 6-6](#). This is password protected at the ROC LOCA, but is viewable at each site.



Category	Warning	Alarm	Current
CPU	85	95	22
Distribution	95	100	20
Product Storage	85	98	20
RDA Radial	85	90	2
RPG Radial	85	90	3

Figure 6-6. Load Shed Categories

## Chapter 7

# RPG Products - Selectable Parameters

---

### 7.1 Selectable Parameters

This chapter addresses the parameters that control the product appearance characteristics of selected products. These characteristics may be modified to highlight significant data values of meteorological conditions.

### 7.2 Cell Product

By altering the maximum number of cells in a product, users have control over both the visual appearance and the size of several products. Decreasing the number of cells required for transmission can decrease the product transmission time and therefore reduce potential narrowband load shedding. In addition, by simplifying the display, it may also enhance the operator's ability to interpret products. However, caution should be exercised when limiting the number of cells included in the product. Decreasing the number of cells displayed may hide information on potentially significant storms ([Figure 7-1](#)).

This window is used to adjust the maximum number of storm cells in the Storm Track Information (STI), Storm Structure (SS), Hail Alphanumeric Products, and the STI and Hail Attribute Tables disseminated to users. The primary reason for limiting the number of storm cells in products is to reduce the product sizes and, hence, reduce the chances of narrowband load shedding. The parameters in this window do NOT affect the number of storm cells identified and tracked or the number of storms cells in the STI and Hail graphic products or overlays. When changing these parameters, one must consider that all users of the product will be affected. A compromise between the number of 'useful' storm cells (in the part of the product) and narrowband load shedding should be the goal. If narrowband load shedding is a problem for users requesting some or all of the SS, STI, Hail Index (HI), and Composite Reflectivity (CR) products, lower the values for all products in this window by the number of cells on one page of the product and observe the results. It is NOT recommended that the number of cells for any product (window row) be reduced to less than 20 cells. If appropriate changes are made to this window and narrowband load shedding is still a problem, consider reducing the number of product requests (from the associated users).

In the range of values, the upper limit is 100, which is the same as the upper limit on the maximum number of storm cells per volume scan. The lower limit for each parameter is the number of storm cells which fit on the first page of that part of the product. For example, there can be up to ten storm cells on the first page of the Hail Alphanumeric Product.

To most efficiently reduce the product sizes, increase or decrease the maximum number of storm cells by the number of storm cells which fit on whole pages of (or part of) a product. The number of storm cells which fit on each page is equal to the lower limit in the range of acceptable values, except for the STI Alphanumeric Product. For example, the number of storm cells per page of the Hail Attribute Table is six. For the STI Alphanumeric Product, the first page lists up to seven storm cells, but each additional page can list up to nine storm cells.

The storm cells for each (part of a product) are sorted by a 'severity' attribute. For example, in the STI product, the storm cells are sorted by cell-based VIL, and secondly, maximum reflectivity. When the number of storm cells identified exceeds the maximum number of storm cells in a particular (part of a) product, the storm cells nearest the top of the sorted list (i.e., 'the most severe' storm cells) are included.

Edit Selectable Product Parameters

Close Save Undo Baseline: Restore Update

Category: ☒ Cell Product ☐ Layer Product ☐ OHP/THP Data Levels  
☐ RCM Product ☐ RCM Reflectivity Data Levels ☐ STP Data Levels  
☐ VAD and RCM Heights ☐ Velocity Data Levels

Cell Product Parameters

Parameter Name	Minimum	Maximum	Current	Units
Max # Cells - STI Alphanumeric Product	7	100	34	storm cells
Max # Cells - SS Alphanumeric Product	10	100	40	storm cells
Max # Cells - Hail Alphanumeric Product	10	100	40	storm cells
Max # Cells - STI Attribute Table	6	100	36	storm cells
Max # Cells - Combined Attribute Table	4	100	32	storm cells
Max # Cells - Hail Attribute Table	6	100	36	storm cells

Figure 7-1. Cell Product



### 7.3 Layer Product

This window allows the specification of the layer definitions for the Layer Composite Reflectivity products. The design allows for four entries to define the three layers. Consequently, the first specified height (Layer 0) defines the bottom of the first layer. The second specified height (Layer 1) defines the top of the first layer and the bottom of the second layer. The third specified height (Layer 2) delineates the top of the second layer and the bottom of the third layer. The fourth specified height (Layer 3) defines the top of the third layer ([Figure 7-2](#)).

All of the editable parameters fall under the ROC LOCA to ensure these layer definitions support the national FAA aerospace monitoring program.

Close

Save

Undo

Baseline: 

Restore

Update

Layer Product Parameters

Category:

☐ Cell Product

☐ RCM Product

☐ WAD and RCM Heights

☐ Layer Product

☐ RCM Reflectivity Data Levels

☐ Velocity Data Levels

☐ OHP/THP Data Levels

☐ STP Data Levels

Layer Product Parameters

Parameter Name	Minimum	Maximum	Current	Units
Layer 0 Height	0	52	2	kft
Layer 1 Height	6	58	24	kft
Layer 2 Height	12	64	33	kft
Layer 3 Height	18	70	60	kft
Range Limit	40	460	230	km

Figure 7-2. Layer Product

### 7.4 One/Three Hour Precipitation (OHP/THP) Data Levels

The displayable range of precipitation accumulation and quantization of accumulations into each color level can be changed by modifying the current displayable precipitation accumulation values. This functionality enables WSR-88D sites to modify the precipitation accumulation values and quantizations to meet local data requirements.

The One-hour Precipitation Accumulation (OHP) and Three-hour Precipitation Accumulation (THP) product data levels are controlled via the same menu, and therefore have the same accumulation and quantization values. In addition, the User Selectable Precipitation (USP) product data levels are controlled by this menu if the USP maximum rainfall is less than the Code 16 value (default = 8.00 inches). If the USP maximum rainfall exceeds the Code 16 value, the USP product data levels are controlled by the Storm Total Precipitation Accumulation (STP) data level menu (see section [7.7](#)). The displayable data levels range from 0.0 to 12.7 inches with a quantization resolution of 0.05 inches.

Modifications to these displayable product data levels will affect all associated users and non-associated users of precipitation accumulation data. Coordination with affected RFCs is recommended.

Edit Selectable Product Parameters

Close Save Undo Baseline: Restore Update

Category: ☐ Cell Product ☐ Layer Product ☐ OHP/THP Data Levels  
☐ RCM Product ☐ RCM Reflectivity Data Levels ☐ STP Data Levels  
☐ VAD and RCM Heights ☐ Velocity Data Levels

-----INSTRUCTIONS-----  
 Permissible value range is from 0.0 to 12.7 inches in multiples of 0.05. The value entered represents the minimum value of the data level.

OHP/THP Data Levels

Code	Current (inches)	Code	Current (inches)
1	ND	9	1.50
2	>	10	1.75
3	>=	11	2.00
4	>=	12	2.50
5	>=	13	3.00
6	>=	14	4.00
7	>=	15	6.00
8	>=	16	8.00

Figure 7-3. OHP/THP Data Levels

7.5 RCM Product

This window defines the parameters for the RCM. See Figure 7-4. This window is edit-able only at the ROC LOCA.

CloseSaveUndoBaseline:RestoreUpdate

☐ Cell Product

☐ RCM Product

☐ VAD and RCM Heights

Category:

☐ Layer Product

☐ RCM Reflectivity Data Levels

☐ Velocity Data Levels

☐ OHP/THP Data Levels

☐ STP Data Levels

RCM Product Parameters

Parameter Name	Minimum	Maximum	Current	Units
Range Threshold	-33.0	94.0	20.0	dBZ
Centroid Count	0	20	12	I

Figure 7-4. RCM Product

## 7.6 RCM Reflectivity Data Levels

This window defines the reflectivity data values for the RCM product only. See [Figure 7-5](#). This window is editable only at the ROC LOCA.

**Edit Selectable Product Parameters**

Baseline: **Restore** **Update**

Category: ☐ Cell Product ☒ RCM Product ☐ VAD and RCM Heights ☐ Layer Product ☒ RCM Reflectivity Data Levels ☐ Velocity Data Levels ☐ OHP/THP Data Levels ☐ STP Data Levels

-----INSTRUCTIONS-----  
 Reflectivity data levels are in the range -33.0 to 95.0 dBZ. Data codes represent the lower (inclusive) cutoff value.

RCM Reflectivity Data Levels

Code	Current (dBZ)
1	ND
2	>=
3	>
4	>
5	>
6	>
7	>

Figure 7-5. RCM Reflectivity Data Levels

### 7.7 STP Data Levels

The STP product data levels are controlled by this window. In addition, the USP product data levels are controlled by this window if the USP maximum value exceeds the Code 16 value (default = 8.00 inches) for the OHP/ THP data levels. If the USP maximum rainfall is less than the OHP/THP Code 16 value, the USP product data levels are controlled by the OHP/THP Data Levels window. The displayable range of precipitation accumulation and quantization of accumulations into each color level can be changed by modifying the current displayable precipitation accumulation values. This functionality enables modification of the precipitation accumulation values and quantizations to meet local data requirements. The displayable data levels range from 0.0 to 25.4 inches, with a quantization resolution of 0.1 inches. See [Figure 7-6](#).

Modifications to these displayable product data levels will affect all associated users and non-associated users of precipitation accumulation data. Coordination with affected RFCs is recommended.

Edit Selectable Product Parameters

Close Save Undo Baseline: Restore Update

Category: ☐ Cell Product ☐ Layer Product ☐ OHP/THP Data Levels  
☐ RCM Product ☐ RCM Reflectivity Data Levels ☒ STP Data Levels  
☐ VAD and RCM Heights ☐ Velocity Data Levels

-----INSTRUCTIONS-----  
 Permissible value range is from 0.0 to 25.4 inches in multiples of 0.1. The value entered represents the minimum value of the data level.

STP Data Levels

Code	Current (inches)	Code	Current (inches)
1	ND	9	3.0
2	>	10	4.0
3	>	11	5.0
4	>	12	6.0
5	>	13	8.0
6	>	14	10.0
7	>	15	12.0
8	>	16	15.0

Figure 7-6. STP Data Levels



## **7.8 VAD and RCM Heights**

This window is used to define the heights (MSL) of the VAD-derived wind estimates for the RCM and the VAD Wind Profile (VWP) products. See Figure 7-7.

### **7.8.1 Delegated Authority Restrictions**

RCM wind direction and speed, as output from the VAD algorithm, shall be reported at 1,000 foot increments from the nearest 1,000 ft MSL above the radar level (surface) to 10,000 feet MSL; then at 2,000 foot increments from 12,000 to 20,000 feet MSL; and at the additional levels of 25,000; 30,000; 35,000 and 50,000 feet MSL. The VAD/RCM heights (up to 19 height values) must be specified as described herein to maintain national RCM wind height consistency. For radars with an elevation above 1000 ft MSL, the change authority is granted to the URC (or Agency field office where no URC exists) for the reassignment of the unused VAD/RCM heights to VAD only heights.

### **7.8.2 VAD Wind Profile (VWP) Display Heights**

The VAD Wind Profile (VWP) Product has the capability to display up to 30 heights. The heights are specified as up to 19 combination VAD and RCM heights (designated by a check mark in both the VAD and RCM columns on the edit window) and the remaining, up to a total of 30 heights, as VAD only (designated by a check in the VAD column only).

In the example window shown in [Figure 7-7](#), the radar elevation is 1200 ft MSL. Therefore, the lowest VAD/RCM height defined on the edit window is the 2 kft height MSL (800 ft above the surface for this location). The "unused" VAD/RCM height (1 kft) was reassigned as VAD only (V) height selections at 45 kft.

[illegible]

Figure 7-7. VAD and RCM Heights

### 7.9 Velocity Data Levels

The displayable range of velocities (maximum inbound to maximum outbound) and the quantification of velocities into each color level can be changed by modifying the velocity data levels in the velocity tables. The WSR-88D provides for eight velocity tables to define the base velocity product's display values. The eight different tables are needed to account for the velocity measurement increment being used and the weather mode. This enables sites to modify the velocity data maximum display values and quantifications to meet local velocity data requirements. For example, sites that are expecting very high sustained winds (e.g., a hurricane is approaching) may elect to modify the 16-level velocity table to display wind speeds from -80 to +80 kts. This modification of the quantification levels may de-emphasize weak velocity values, and help to better differentiate tropical cyclone and hurricane force wind speeds.

#### 7.9.1 Select Velocity Table

There are eight velocity tables stored at the RPG. See Figures [7-8](#) through [7-15](#). Each table defines the velocity quantifications for a particular weather mode and velocity measurement increment. The velocity data levels windows shown below define the Velocity Tables as well as allowing for the selection of velocity data levels for each table.

Modifications to the velocity product data levels will affect all associated users and non-associated users of velocity data.

Edit Selectable Product Parameters

Close Save Undo Baseline: Restore Update

Category: ☐ Cell Product ☐ Layer Product ☐ OHP/THP Data Levels  
☐ RCM Product ☐ RCM Reflectivity Data Levels ☐ STP Data Levels  
☐ VAD and RCM Heights ☒ Velocity Data Levels

Select Velocity Table

☒ (Precip 16/0.97) ☐ (Clear Air 16/0.97)  
☐ (Precip 16/1.94) ☐ (Clear Air 16/1.94)  
☐ (Precip 8/0.97) ☐ (Clear Air 8/0.97)  
☐ (Precip 8/1.94) ☐ (Clear Air 8/1.94)

-----INSTRUCTIONS-----  
 Select a table from the above list. Edits to the + side are reflected in the - side. The allowable value range is from 2 to 122 kts

Velocity Data Levels

Code	Current (knots)
1	ND
2	-64
3	-50
4	-36
5	-26
6	-20
7	-10
8	-1

Code	Current (knots)
9	0
10	10
11	20
12	26
13	36
14	50
15	64
16	RF

Figure 7-8. Velocity Data Levels - Precip 16/0.97

Close

Save

Undo

Baseline: 

Restore

Update

Category:

☐ Cell Product

☐ RCM Product

☐ VAD and RCM Heights

☐ Layer Product

☐ RCM Reflectivity Data Levels

☒ Velocity Data Levels

☐ OHP/THP Data Levels

☐ STP Data Levels

Select Velocity Table

☐ (Precip 16/0.97)

☒ (Clear Air 16/0.97)

☐ (Precip 16/1.94)

☐ (Clear Air 16/1.94)

☐ (Precip 8/0.97)

☐ (Clear Air 8/0.97)

☐ (Precip 8/1.94)

☐ (Clear Air 8/1.94)

-----INSTRUCTIONS-----

Select a table from the above list. Edits to the + side are reflected in the - side. The allowable value range is from 2 to 244 kts

Velocity Data Levels

Code

Current (knots)

1

ND

2

-64

3

-50

4

-36

5

-26

6

-20

7

-10

8

-1

Code

Current (knots)

9

0

10

10

11

20

12

26

13

36

14

50

15

64

16

RF

Figure 7-9. Velocity Data Levels - Precip 16/1.94

Edit Selectable Product Parameters

Close Save Undo Baseline: Restore Update

Category: ☐ Cell Product ☐ Layer Product ☐ OHP/THP Data Levels  
☐ RCM Product ☐ RCM Reflectivity Data Levels ☐ STP Data Levels  
☐ VAD and RCM Heights ☒ Velocity Data Levels

Select Velocity Table

☐ (Precip 16/0.97) ☐ (Clear Air 16/0.97)  
☐ (Precip 16/1.94) ☐ (Clear Air 16/1.94)  
☒ (Precip 8/0.97) ☐ (Clear Air 8/0.97)  
☐ (Precip 8/1.94) ☐ (Clear Air 8/1.94)

-----INSTRUCTIONS-----  
 Select a table from the above list. Edits to the + side are reflected in the - side. The allowable value range is from 2 to 122 kts

Velocity Data Levels

Code	Current (knots)
1	ND
2	-10
3	-5
4	-1

Code	Current (knots)
5	0
6	5
7	10
8	RF

Figure 7-10. Velocity Data Levels - Precip 8/0.97

Close

Save

Undo

Baseline:

Restore

Update

Edit Selectable Product Parameters

Category:

☐ Cell Product

☐ RCM Product

☐ VAD and RCM Heights

☐ Layer Product

☐ RCM Reflectivity Data Levels

☒ Velocity Data Levels

☐ OHP/THP Data Levels

☐ STP Data Levels

Select Velocity Table

☐ (Precip 16/0.97)

☐ (Clear Air 16/0.97)

☐ (Precip 16/1.94)

☐ (Clear Air 16/1.94)

☐ (Precip 8/0.97)

☐ (Clear Air 8/0.97)

☒ (Precip 8/1.94)

☐ (Clear Air 8/1.94)

-----INSTRUCTIONS-----  
Select a table from the above list. Edits to the + side are reflected in the - side. The allowable value range is from 2 to 244 kts

Velocity Data Levels

Code

1

Code

2

Code

3

Code

4

Current (knots)

ND

-10

-5

-1

Code

5

Code

6

Code

7

Code

8

Current (knots)

0

5

10

RF

Figure 7-11. Velocity Data Levels - Precip 8/1.94

Close

Save

Undo

Baseline:

Restore

Update

Edit Selectable Product Parameters

Category:

☐ Cell Product

☐ RCM Product

☐ VAD and RCM Heights

☐ Layer Product

☐ RCM Reflectivity Data Levels

☒ Velocity Data Levels

☐ OHP/THP Data Levels

☐ STP Data Levels

Select Velocity Table

☐ (Precip 16/0.97)

☐ (Precip 16/1.94)

☐ (Precip 8/0.97)

☐ (Precip 8/1.94)

☒ (Clear Air 16/0.97)

☐ (Clear Air 16/1.94)

☐ (Clear Air 8/0.97)

☐ (Clear Air 8/1.94)

-----INSTRUCTIONS-----

Select a table from the above list. Edits to the + side are reflected in the - side. The allowable value range is from 2 to 122 kts

Velocity Data Levels

Code	Current (knots)
1	ND
2	-64
3	-50
4	-36
5	-26
6	-20
7	-10
8	-1

Code	Current (knots)
9	0
10	10
11	20
12	26
13	36
14	50
15	64
16	RF

Figure 7-12. Velocity Data Levels - Clear Air 16/0.97



Close

Save

Undo

Baseline:

Restore

Update

Edit Selectable Product Parameters

Category:

☐ Cell Product

☐ RCM Product

☐ VAD and RCM Heights

☐ Layer Product

☐ RCM Reflectivity Data Levels

☒ Velocity Data Levels

☐ OHP/THP Data Levels

☐ STP Data Levels

Select Velocity Table

☐ (Precip 16/0.97)

☐ (Clear Air 16/0.97)

☐ (Precip 16/1.94)

☒ (Clear Air 16/1.94)

☐ (Precip 8/0.97)

☐ (Clear Air 8/0.97)

☐ (Precip 8/1.94)

☐ (Clear Air 8/1.94)

-----INSTRUCTIONS-----  
Select a table from the above list. Edits to the + side are reflected in the - side. The allowable value range is from 2 to 244 kts

Velocity Data Levels

Code

Current (knots)

1

ND

2

-64

3

-50

4

-36

5

-26

6

-20

7

-10

8

-1

Code

Current (knots)

9

0

10

10

11

20

12

26

13

36

14

50

15

64

16

RF

Figure 7-13. Velocity Data Levels - Clear Air 16/1.94

Edit Selectable Product Parameters

Category:
 ☐ Cell Product
 ☐ Layer Product
 ☐ OHP/THP Data Levels

☐ RCM Product
 ☐ RCM Reflectivity Data Levels
 ☐ STP Data Levels

☐ VAD and RCM Heights
 ☒ Velocity Data Levels

Select Velocity Table
 ☐ (Precip 16/0.97)
 ☐ (Clear Air 16/0.97)
 ☐ (Precip 16/1.94)
 ☐ (Clear Air 16/1.94)
 ☒ (Precip 8/0.97)
 ☐ (Clear Air 8/0.97)
 ☐ (Precip 8/1.94)
 ☐ (Clear Air 8/1.94)

-----INSTRUCTIONS-----

Select a table from the above list. Edits to the + side are reflected in the - side. The allowable value range is from 2 to 122 kts

Velocity Data Levels

Code	Current (knots)
1	ND
2	-10
3	-5
4	-1

Code	Current (knots)
5	0
6	5
7	10
8	RF

Figure 7-14. Velocity Data Levels - Clear Air 8/0.97

Close

Save

Undo

Baseline: 

Restore

Update

Category:

☐ Cell Product

☐ RCM Product

☐ VAD and RCM Heights

☐ Layer Product

☐ RCM Reflectivity Data Levels

☒ Velocity Data Levels

☐ OHP/THP Data Levels

☐ STP Data Levels

Select Velocity Table

☐ (Precip 16/0.97)

☐ (Clear Air 16/0.97)

☐ (Precip 16/1.94)

☐ (Clear Air 16/1.94)

☐ (Precip 8/0.97)

☐ (Clear Air 8/0.97)

☐ (Precip 8/1.94)

☒ (Clear Air 8/1.94)

-----INSTRUCTIONS-----  
Select a table from the above list. Edits to the + side are reflected in the - side. The allowable value range is from 2 to 244 kts

Velocity Data Levels

Code

1

Current (knots)

ND

Code

2

Current (knots)

-10

Code

3

Current (knots)

-5

Code

4

Current (knots)

-1

Code

5

Current (knots)

0

Code

6

Current (knots)

5

Code

7

Current (knots)

10

Code

8

Current (knots)

Rf

Figure 7-15. Velocity Data Levels - Clear Air 8/1.94

# Chapter 8

## RPG Products - Algorithms

---

### 8.1 URC Algorithm Parameters

This chapter presents the default settings for the thirteen WSR-88D meteorological algorithms retaining URC LOCA. If the algorithm has no URC LOCA adaptable parameter, it is not available on the pull down menu. Of the thirteen algorithms that are displayed, only those values with URC LOCA within the algorithm are displayed and, therefore, editable.

The algorithms are presented in alphabetical order as seen in the pull down menu of the Algorithms menu. One algorithm, Hydromet Preprocessing, has more parameters than can be shown in the initial window. Use the scroll bar on the right hand side to view the remaining parameters.

Environmentally sensitive algorithm parameters (examples: 0 and -20 degree Celsius heights, default storm motion, etc) should be routinely modified to improve algorithm performance.

CAUTION is warranted, however. Modifications to some algorithm parameters may have a significant detrimental impact on the performance, accuracy, and reliability of the target algorithm and related products, as well as on the RPG system performance. Algorithm research activity MUST NOT be done on the operational WSR-88D system. It can be accomplished using Archive II data and local processing and display systems.

### 8.2 Combined Shear

The Combined Shear algorithm is intended to assist the user in identifying shear regions such as along gust fronts and in mesocyclones. See [Figure 8-1](#). It is especially useful in that, unlike the human operator, it isn't keying off color contrasts. The combined shear algorithm computes estimates of shear along a radial and also gate-to-gate tangentially between two radials. These two measures are mapped onto separate Cartesian grids whose resolutions are controlled by the domain resolution (DOR) adaptable parameter. These two measures are combined by taking the square root of the sum of the squares of each estimate. The combined shear may be smoothed by applying an equally weighted two-dimensional filter to the gridded field. The filter is always centered on a grid point. Thus, it is required to have odd-numbered integer dimensions. The adaptable parameter number filter (NFL) adjusts the size of the filter and is specified as the total number of points in the filter. For example, a value of 25 for NFL indicates that a 5 x 5 point filter is being used. Because this algorithm is CPU-intensive, the user is restricted

to applying it to only one elevation at a time. The default elevation scan is the 0.5 degree elevation scan. Each unique elevation angle is numbered sequentially from 1 to the highest number in the VCP. For VCP 21 the highest valid number is 9 and for VCP 11 the highest valid number is 14. The adaptable parameter elevation cut (ELEV) being set to 1 points to the 0.5 degree elevation. Once a combined shear field is generated, the Combined Shear Contour product may be generated.

Changing the adaptable parameters DOR and NFL affects the magnitude of the shear displayed, the granularity and resolution of the data, and processing load on the RPG. The algorithm computes the average of all radial and tangential shears in their respective Cartesian grids. Increasing the value of DOR increases the number of shear values that are averaged together, which effectively lowers the maximum value of shears that will be displayed. Conversely, decreasing DOR will cause fewer shear values to be mapped to any particular grid location. With fewer values averaged together, greater extremes will be displayed. At 0.5 km resolution there is not enough resolution in the radial data to map a shear value to each Cartesian grid point. This results in a grainy appearance in the product. However, increasing DOR to 4 km may coarsen the product sufficiently to mask significant shear-producing features. The adaptable parameter NFL, by filtering the data further, reduces peak shear values. It will also "smear" data into empty grid points that are neighboring grid points with shear.

### NOTE

A value of 1 for NFL does no filtering and a value of 25 does the most smoothing.

Because the overall domain remains fixed at 232 x 232 km, increasing the resolution from 4 km to 0.5 km increases the number of bins in the Cartesian grid by a factor of 64, and thus increases the amount of processing that must be performed by the RPG. Changing the NFL from 1 to 25 further significantly increases the processing load.

Close

Save

Undo

Baseline:

Restore

Update

Adaptation Item

Combined Shear

Value

Range

Domain (Resolution) [DOR]	1.0	0.5, 1.0, 2.0, 4.0, km
Number (Filter) [NFL]	9	1, 9, 25
Threshold (Combined Shear) [THCS]	2.0	0.0 <= x <= 5.0, E10-3/sec
Elevation Cut [ELEV]	1	1 <= x <= 20, elevation no

Figure 8-1. Algorithms - Combined Shear

### **8.3 Hail Detection**

The Hail Detection algorithm (see [Figure 8-2](#)) provides for each storm cell the following three estimates:

- Probability of Hail (POH) of any size,
- Probability of Severe Hail (POSH) (or hail > 3/4" in diameter), and
- Maximum Expected Hail Size (MEHS).

Based on drop-size/hailstone distribution and empirical studies, the algorithm assumes that large reflectivity values observed aloft (above the freezing level (0°C)) are most likely hail. The algorithm's inputs are environmental data and storm cells components' maximum reflectivity and height above ground level (AGL). The environmental data is the height (MSL) of the 0°C and -20°C environmental temperatures. Hail estimates are only provided for storm cells identified within the Maximum Hail Processing Range; beyond that range hail estimates are labeled 'UNKNOWN'.

To determine the POH of any size for each storm cell, the height of the highest component with a maximum reflectivity value of at least Thresh Min Reflectivity POH, which is above the freezing level, is used in an empirical relationship. The higher the component is above the freezing level, the greater the POH. The increasing heights correlate to probabilities through the POH Height Difference parameters.

To determine the POSH and MEHS for each storm cell, the algorithm uses a relationship between reflectivity and the Hailfall Kinetic Energy (HKE), the flux of kinetic energy of hailstones. HKE is calculated from components with maximum reflectivity values (of at least Thr HKE Ref Wgt Lower Lim) above the freezing level using an equation with the HKE Coefficients. The computation is weighted toward those components with a maximum reflectivity of at least Thr HKE Ref Wgt Upper Lim. A vertical integration of the HKE is done for all components within a storm cell (which meet the relative height and reflectivity criteria), resulting in a parameter called the Severe Hail Index (SHI). The integration is weighted toward those components above the height of the -20°C environmental temperature. The greater the collective depth of components in a storm cell with large HKE values and the higher those components are above the freezing level, the larger a storm cell's SHI value. The MEHS for each storm cell is computed using SHI in an empirical formula with the SHI Hail Size Coefficient and SHI Hail Size Exponent. The POSH is calculated from SHI, the POSH Coefficient, the POSH Offset, and a warning threshold which is a function of the height of the freezing level, the Warn Thresh Select Model (WTSM) Coefficient, and the Warn Thresh Select Model Offset\*.

**NOTE**

The Warn Thresh Select Model Offset is a site specific parameter based on the RDA height msl.

For the RCM product, the POSH is converted to a Hail Index using the Threshold (RCM Probable Hail) and Threshold (RCM Positive Hail) parameters.

### **8.3.1 Delegated URC Authority**

The ROC authorizes the URC to modify the Probability of Severe Hail (POSH) setting for the Hail Detection algorithm within the restrictions defined below.

The default value for POSH Offset is 50%. The URC may lower this value to 30% when summertime atmospheric conditions are present. Summertime atmospheric conditions are characterized by a relatively high melting level ( $> 13$  kft) and low vertical shear ( $< 30$  kts at 500 mb). When the summertime environment is no longer present the POSH Offset should be reset to 50%.

### **8.3.2 Supplemental Information - Hail Detection**

The last six entries in the Hail algorithm represent the Date/Time that the 0 degree and/or the -20 degree isotherm levels are updated. The entries are under URC LOCA. However, these entries are automatically updated once the heights are changed for either the 0 degree or the -20 degree isotherms.



Algorithms

Close Save Undo Baseline: Restore Update

Adaptation Item Hail Detection

Name	Value	Range
POSH Offset	50	1 <= x <= 100, %
Height (0 Deg Celsius)	10.5	0.0 <= x <= 70.0, kft
Height (-20 Deg Celsius)	20.0	0.0 <= x <= 70.0, kft
Hail Date YY	96	0 <= x <= 99, year
Hail Date MM	1	1 <= x <= 12, month
Hail Date DD	1	1 <= x <= 31, day
Hail Time HH	12	0 <= x <= 23, hrs
Hail Time MM	0	0 <= x <= 59, mins
Hail Time SS	0	0 <= x <= 59, secs

Figure 8-2. Algorithms - Hail Detection

## **8.4 Hydromet Adjustment**

The Hydromet Adjustment algorithm determines a mean-field, multiplicative Bias correction factor that may be applied to selected PPS rainfall accumulation products. A table of rain gage/radar biases (i.e., G/R Biases) for varying time durations ranging from short term to climatological is determined, hourly, in the Multisensor Precipitation Estimator function of AWIPS and sent to the RPG. There, it is ingested by the Adjustment algorithm and a single, "best" G/R Bias is extracted from the table, based upon the first row (evaluating from short to long term memory span) whose analysis was based upon an effective number of Gage-Radar Pairs exceeding the Gage/Radar Pairs Threshold (NGRPS). See Figure 8-3. The default setting of this parameter is 10 with a range of 6-30; if the user wishes the selected bias to trend more towards the short term - i.e., based on the present precip event - NGRPS may be lowered; whereas if the user wishes it to trend more towards the long term - i.e., seasonal or climatological - NGRPS may be raised. Note that this parameter will also be dependent on the density of reporting rain gages under the radar umbrella, and the default may be raised in the presence of a dense network.

If Bias Tables are not received from AWIPS on a regular, hourly basis, a self adjusting procedure kicks in to modify the biases in the most recent Bias Table on hand in the RPG toward more climatological values and the selection process continues as above, but if the Longest Time Lag (LGLAG) is exceeded, the default Bias is reset to the Reset Value of the G/R Estimate (RESBI). The Reset Value is also that used upon startup.

Once the G/R Bias value is determined, it is not automatically applied to all the PPS accumulation products. Whether or not it is applied to any is determined by the setting of the (URC LOCA) Bias Flag. Note that the default setting of this flag is FALSE, so that user action is required to turn it on.

### **8.4.1 Effects of Bias Flag on RPG PPS Products**

Since the Bias Flag may be turned on and off by the operator during a precipitation event, the long duration PPS accumulation products may contain a mixture of periods when G/R Bias adjustments were Applied and were Not applied. The effects on the individual RPG PPS accumulation products are as follows:

- OHP (Hourly accumulation ending at the current volume scan or, when the "top of the hour" is passed, covering the most recent Clock Hour): The value of the G/R Bias at the end of the hour is applied to the entire hour's accumulation if the Bias Flag is ON; the accumulation field is entirely uncorrected if the flag is OFF.
- THP, USP (Multi-hourly accumulations ending at the top of the hour): Each component clock-hour's accumulation is entirely corrected or non-

corrected dependent upon whether the Bias Flag was ON or OFF at the end of that hour.

- STP, DSP (Storm Total accumulations ending presently or at the end of a defined precipitation event): The contributions from each scan-to-scan accumulation period (i.e., at the end of each volume scan) are either corrected or non-corrected before being added to the existing totals, dependent upon the momentary setting of the Bias Flag.
- DPA (Hourly digital accumulation): The G/R Bias is never applied in the PPS, but the value at the end of the hour is appended to the product for potential, external application.

Note: once a determination (True/False) is made for the Bias Flag, it is recommended that the setting remain in effect for the duration of the present precipitation event.

Algorithms

Close

Save

Undo

Baseline:

Restore

Update

Adaptation Item

Hydromet Adjustment

Range

Name

Value

Range

Bias Flag

False

False, True

Figure 8-3. Algorithms - Hydromet Adjustment

## **8.5 Hydromet Preprocessing**

The RPG Build 5.0 Hydromet Preprocessing uses the internal Enhanced Preprocessing Algorithm (EPRE) to prepare the precipitation detection and hybrid scan data for further processing by the precipitation algorithms.

EPRE takes Base Reflectivity data, Clutter/AP Percent Likelihood data, and terrain-based Blockage data to produce the Hybrid Scan intermediate product, which is used by the downstream Precipitation Processing System (PPS) algorithms and products as the basis for the determination of all rainfall rates and accumulations. It is a replacement for the original Precipitation Preprocessing Algorithm, assembling the Hybrid Scan in a somewhat different manner.

The algorithm works on the fundamental premise that the lowest unblocked, uncontaminated sample bin will be used at any location. Starting at the lowest elevation, a given sample bin is tested first against a Blockage Threshold, then to see whether it is contained within an Exclusion Zone, then to see whether its clutter likelihood is less than a Clutter Threshold (Exclusion Zones are user-defined regions to account for residual clutter due to man-made objects such as buildings or wind farms, large tree growth, etc.). If all tests are passed, then that bin's contribution to the adjacent slots on the fixed, 1 degree-wide Hybrid Scan grid are weighted to those slots. If the combined weight of contributions in a given, fixed-grid sample bin location exceeds a Weight Threshold, then that sample bin's reflectivity is used in the Hybrid Scan. Otherwise, processing continues at the next higher elevation until all tests are passed at that location. At the end of each elevation scan, the percentage of fixed-grid bin locations filled in the Hybrid Scan is tested against a Full Hybrid Scan Threshold and, if exceeded (or if the next-to-highest elevation scan has been processed), the Hybrid Scan is considered "full" and is released into the output linear buffer for use by the downstream PPS tasks (Note that all thresholds referred to above are algorithm adaptation data).

Compared to the previous version of this algorithm (commonly known as "PREPROC"), this version uses higher-resolution terrain blockage information in determination of beam blockage; uses AP/Clutter likelihood information to identify and remove clutter contamination; allows the definition of Exclusion Zones (via adaptation data) to enable identification and removal of areas of persistent, residual clutter; spatially averages incoming radials into the fixed, 1 degree wide slots of the Hybrid Scan, (rather than laterally moving them to the nearest slot); and can build the Hybrid Scan "dynamically" by accommodating the elevation strategy of any, operational NEXRAD Volume Coverage Pattern (VCP), rather than being confined to the fixed set of low-elevation angles shared by all the operational VCPs in effect to date.

EPRE also differs from PREPROC in that it performs its own Rainfall Identification function off of the fully-assembled Hybrid Scan, analogous to that performed by the Precipita-

tion Detection Function (PDF) off of base reflectivity data. The downstream PPS tasks now respond to this Rainfall Identification from EPRE in determination of the start/stop times of precipitation "events" (such as in the Storm Total Precip (STP) product), rather than the determinations from PDF. (Note that the PDF has not been removed and may still be used in the determination of the official Precipitation Category, the Weather Mode, and the Pulse Repetition Frequency.)

Within the algorithm, there are several parameters that can be modified at the URC Level. See Figure 8-4. These parameters are described below.

### **8.5.1 Max Allowable Percent Likelihood of Clutter (CLUTTHRESH)**

The (URC LOCA) Clutter Threshold (CLUTTHRESH) should be tuned to best discern AP/Clutter from actual precipitation. If set too high, it will be too difficult to reject sample bins that may predominantly represent clutter, resulting in their incorporation into the Hybrid Scan and, ultimately, their erroneous integration into rainfall totals. If set too low, sample bins that may predominantly represent rainfall may be rejected, usually resulting in sample bins from higher elevations being used instead. In this circumstance, rainfall at these az/ran locations will usually be underestimated, due to the typical fall off of reflectivity with height in the vertical reflectivity profile (especially during stratiform precipitation events), although in some situations, the opposite will be true, e.g., if the sample bin at the higher elevation is within a bright band (i.e., melting) layer. In either case, the reflectivity sample bin from above is less likely to yield an accurate estimate of precipitation at the surface, below.

The current, default setting of CLUTTHRESH is 75%. This seemingly high value has been enacted because, in "range folded" or range-ambiguous regions (indicated by the appearance of "purple haze" in low-level, base velocity fields), the REC algorithm tends to generate abnormally high readings of AP/Clutter %, which may result in a rather high likelihood of "real" rainfall echoes being rejected. The user should carefully monitor the presence and extent of "purple haze" in products such as low-level Base Velocity and Clutter Likelihood - Doppler. In situations where the "purple haze" in these products is extensive and where readings at the corresponding locations in the Clutter Likelihood - Reflectivity product are visibly high compared to the remainder of the field, the user should retain the default of 75% (see Figure 8-4). However, in situations where it is observed that range folding is not prevalent, the Clutter Threshold should be set to a lower value, with 50% recommended.

New Volume Coverage Patterns (VCPs) that employ Multi-PRF Velocity Dealiasing (which tends to minimize the extent of range unambiguous regions, such as VCP 121) are planned to be incorporated into NEXRAD operations increasingly in the

upcoming years. When these VCPs are in use, a setting in the vicinity of 50% for the Clutter Threshold would typically be more appropriate.

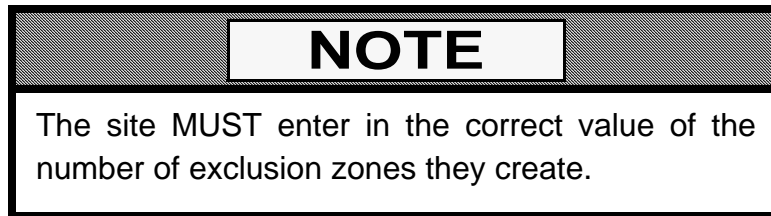
### 8.5.2 Number of Exclusion Zones (NEXZONE)

This is the number of zones to be excluded from the HYBRID SCAN (Reflectivity) Array. The values may range from 0 to 20, defaults is 0, and the precision is 1. These Exclusion Zones that the site creates can prevent known areas of persistent clutter residue (for instance, wind generator farms) from contaminating the HYBRID SCAN. This number controls how many zones are included in the processing.

#### EXAMPLES:

If 5 is entered as this value, the algorithm will incorporate the first five exclusion zones (#1 through #5).

If 0 is entered as this value, yet exclusion zones are created in the following blocks, they will not be used in the processing of the algorithm.



### 8.5.3 Exclusion Zones

There are a total of 20 Exclusion Zones (see Figure 8-4). The four Exclusion Zones shown in Figure 8-4 illustrate how Zones 1 through 4 appear in the window. Use the scroll bar down the right hand side of the window to display the remainder of the zones. Each zone has five parameters to enter:

- Begin Azimuth
- End Azimuth
- Begin Range
- End Range
- Max Elevation Angle

Enter the Azimuth angles to the tenth of a degree. Start at 0 degrees and enter the azimuth angles with clockwise values (e.g., 60 to 75 degrees). Do not make an azimuth range pass through 360 degrees. Enter the Range to the whole nautical mile, from the closest point in to the furthest distance away (e.g., 16 to 21 nm). Enter the

Elevation Angle to the tenth of a degree. The elevation angle entered represents the top of the zone, with the bottom being a default of 0.0 degrees. In order for each zone to be evaluated in the algorithm, it must be counted as one of the zones in the Number of Exclusion Zones (NEXZONE) parameter. They also must be in numerical sequence in order to be utilized.

In Build 5, there were three Exclusion Zones, which were hard coded into the software. These were created to mitigate residual clutter and potentially high accumulations close to the RDA. This is accomplished by excluding some of the lower elevations at close ranges to the RDA. In addition to the hard coded zones in Build 5, the user had an additional 20 editable (blank) Exclusion Zones that they could define.

In Build 6, Exclusion Zones 1 through 20 are all editable through the URC LOCA. The three Exclusion Zones which were hard coded in the Build 5 software are not merged forward when Build 6.0 is loaded. However, any Exclusion Zone that was manually entered in Build 5 will merge forward and become part of Exclusion Zones 1-20.

The three Exclusion Zones which were hard coded in the Build 5 software can be manually entered into the Build 6 software. Most sites will not need to enter in these three Exclusion Zones. For the handful of sites which have an operational need to retain these zones, they must manually add them into the Hydromet Pre-processing Algorithm screen (Figure 8-4). The default values for Exclusion Zones 1 through 3 are:

- Exclusion Zone Limits #1:
  - Azimuth: Beginning azimuth 0 degrees and ending azimuth 360 degrees
  - Range: Beginning range 0 nm and ending range 25 nm
  - Max Elevation angle: 0.6 degrees
- Exclusion Zone Limits #2:
  - Azimuth: Beginning azimuth 0 degrees and ending azimuth 360 degrees
  - Range: Beginning range 0 nm and ending range 9 nm
  - Max Elevation angle: 1.0 degrees
- Exclusion Zone Limits #3:
  - Azimuth: Beginning azimuth 0 degrees and ending azimuth 360 degrees
  - Range: Beginning range 0 nm and ending range 5 nm
  - Max Elevation angle: 1.6 degrees



### NOTE

Using Exclusion Zones can result in an occasional ring structure close to the RDA on precipitation products. It will be most apparent in low-topped stratiform events and least likely to occur with deep convection. Also, remember to not leave a blank Exclusion Zone between desired Exclusion Zones in this screen.

#### 8.5.4 Precipitation Detection Functionality within EPRE

A precipitation detection-like function has been incorporated into the new, "Enhanced" version of the Precipitation Preprocessing algorithm, EPRE, which replaced the Legacy version of the algorithm (commonly referred to as PREPROC) in Open RPG Build 5. In this functional component, the reflectivity at each sample bin on the assembled Hybrid Scan is compared against the Rain dBZ Threshold (Reflectivity (dBZ) Representing Significant Rain [RAINZ]). The areas of those sample bins that exceed the threshold are summed over the entire scan and then compared against the Rain Area Threshold (Area with Reflectivity Exceeding Significant Rain Threshold [RAINA]). If that is exceeded, precipitation is said to have been "Detected" and flags are set which affect the operations of the downstream PPS tasks, including (if this is the first time rain has been detected in quite a while) resetting the starting time of the Storm Total Precipitation (STP) and Digital Storm Total Precipitation (DSP) products. When the rain stops, the time since precipitation was last detected is tested against the Rain Time Threshold (RAINT); once exceeded, the rainfall event is considered to be over and the Storm Total accumulation fields are reset to zero.

### NOTE

The preliminary Precipitation Detection Function, itself, is still executed and its results are still used in determining the official Rainfall Category and Precipitation Mode. It is no longer used in the PPS to determine the start/stop times of precipitation events, however.

Algorithms			
Close Save Undo		Baseline: Restore Update	
Adaptation Item	Hydromet Preprocessing	Value	Range
Name			
Maximum Allowable Percent Likelihood of Clutter [CLUTTHRESH]		50	0 <= x <= 100, %
Reflectivity (dBZ) Representing Significant Rain [RAINZ]		20.0	10.0 <= x <= 30.0, dBZ
Area with Reflectivity Exceeding Significant Rain Threshold [RAINA]		80	0 <= x <= 82800, km*2
Number of Exclusion Zones [NEXZONE]		3	0 <= x <= 20
Exclusion Zone Limits # 1 - Begin Azimuth #1		0.0	0.0 <= x <= 360.0, degrees
- End Azimuth #1		360.0	0.0 <= x <= 360.0, degrees
- Begin Range #1		0	0 <= x <= 124, nm
- End Range #1		25	0 <= x <= 124, nm
- Max Elevation Angle #1		0.6	0.0 <= x <= 19.5, degrees
Exclusion Zone Limits # 2 - Begin Azimuth #2		0.0	0.0 <= x <= 360.0, degrees
- End Azimuth #2		360.0	0.0 <= x <= 360.0, degrees
- Begin Range #2		0	0 <= x <= 124, nm
- End Range #2		9	0 <= x <= 124, nm
- Max Elevation Angle #2		1.0	0.0 <= x <= 19.5, degrees
Exclusion Zone Limits # 3 - Begin Azimuth #3		0.0	0.0 <= x <= 360.0, degrees
- End Azimuth #3		360.0	0.0 <= x <= 360.0, degrees
- Begin Range #3		0	0 <= x <= 124, nm
- End Range #3		5	0 <= x <= 124, nm
- Max Elevation Angle #3		1.6	0.0 <= x <= 19.5, degrees
Exclusion Zone Limits # 4 - Begin Azimuth #4		0.0	0.0 <= x <= 360.0, degrees
- End Azimuth #4		0.0	0.0 <= x <= 360.0, degrees
- Begin Range #4		0	0 <= x <= 124, nm
- End Range #4		0	0 <= x <= 124, nm
- Max Elevation Angle #4		0.0	0.0 <= x <= 19.5, degrees

Figure 8-4. Algorithms - Hydromet Preprocessing

## 8.6 Hydromet Rate

The following information describes the Maximum Precipitation Rate and the Z-R Coefficients, plus provides additional references (Figure 8-5).

### 8.6.1 Max Precipitation Rate (MXPRA)

The adaptable parameter MXPRA defines the maximum instantaneous rainfall rate (in mm/hr) that the Precipitation Processing Subsystem (PPS) uses to estimate rainfall. MXPRA should be used to mitigate contamination of radar rainfall estimates caused by the high reflectivity values associated with hail. The value of MXPRA can be changed using a URC password. Operators should set the value depending on atmospheric conditions and on their experienced observation of WSR-88D data and products.

There is no fixed optimum value for MXPRA, instead it is a function of the atmospheric conditions which determine climatological maximum rainfall rates. A limited study by the Forecast Systems Laboratory (Kelsch, 1992) showed that the range of maximum radar-based rainfall rates extends from about 63 mm/hr (2.5 in/hr) in semiarid and arid climates to 328 mm/hr (~13 in/hr) in record tropical convective rainfalls. Considering the rarity and small areal extent of very heavy rain events and the significant overestimation that can be caused by hail contamination, the ROC recommends that MXPRA never be set higher than 200 mm/hr (~8 in/hr). Table 8-1 can be used as guidance to help establish the proper value for MXPRA.

Table 8-1. Rain Fall Rate vs. Equivalent Reflectivity	
Climate/regime	MXPRA Value
Arid - High Plains Spring	75 mm/hr (~3 in/hr)
Central Plains Spring, High Plains Summer	100 mm/hr (~4 in/hr)
Central Plains Summer, Gulf Coast Spring	125 mm/hr (~5 in/hr)
Tropical - Gulf Coast Summer	150 mm/hr (~6 in/hr)

The determination of an operational value for MXPRA is complicated because climatological maximum rainfall rates can be highly variable, there is no clearly defined value that separates rain from hail, and rain and hail frequently occur in the same radar bin. Generally, the value of MXPRA should be higher in a deep moist airmass than in a dry shallow airmass. Changing the value of MXPRA within the limits in Table 8-1 will affect only small areas of rainfall in the cores of thunderstorms. However, improperly setting the value of MXPRA can significantly degrade rainfall

estimates in those areas. If the value is set too low, areas of intense rainfall could be underestimated, causing forecasters to miss flash flood events. If the value is set too high, the contamination from hail or wet ice can generate small regions of seriously overestimated rainfall, degrading River Forecast Center models and potentially leading to false flash flood warnings.

#### References:

Kelsch, M., 1992, Estimating Maximum Convective Rainfall Rates for Radar-derived Accumulations, Preprints, Fourth Workshop on Operational Meteorology, Whistler, B.C., Canada, American Meteorological Society, Boston, MA.

### 8.6.2 Z-R Coefficients (CZM and CZP)

The Z-R Multiplier Coefficient (CZM) and Z-R Exponent Coefficient (CZP) define the relationship that the PPS uses to convert from reflectivity (Z) to rainfall rate (R) using the following equation:

$$Z = CZM \times R^{CZP}$$

The selection of a valid Z-R relationship may be the single most important factor contributing to the accuracy of radar-based rainfall estimates. Sites can modify CZM and CZP using the URC password.

The optimum Z-R relationship is a function of numerous variables, including the season, the geographic location, and expected weather type. The ROC recommends that sites use the five relationships in Table 8-2 as guidance in selecting the best Z-R relationship for a rain event.

Table 8-2. Recommended Z-R Relationship		
Relationship	Optimum for:	Also recommended for:
WSR-88D Convective ( $Z=300R^{1.4}$ )	Summer deep convection	Other non-tropical convection
Rosenfeld Tropical ( $Z=250R^{1.2}$ )	Tropical convective systems	
Marshall-Palmer ( $Z=200R^{1.6}$ )	General stratiform precipitation	
East-Cool Stratiform ( $Z=130R^{2.0}$ )	Winter stratiform precipitation - east of continental divide	Orographic rain - East
West-Cool Stratiform ( $Z=75R^{2.0}$ )	Winter stratiform precipitation - west of continental divide	Orographic rain - West

When mixed precipitation types are present, select a Z-R relationship based on the most significant and/or most widespread type of precipitation.

The guidance in Table 8-2 is based on several years of operational WSR-88D experience and a number of studies.

- The WSR-88D Convective relationship was used as the early default NEXRAD relationship and is most applicable in deep summertime convection.
- The Rosenfeld-Tropical relationship (Rosenfeld, et al., 1993) was developed to improve PPS rainfall estimate in tropical convective systems, particularly during land falling hurricanes and tropical storms.
- The Marshall-Palmer relationship (Marshall, et al., 1955), should provide the best PPS estimates during general stratiform rainfall events.
- Studies of cool season stratiform rain events (Super and Holroyd, 1998; Cairns, et al., 1998; Huggins and Kingsmill, 1998; and Quinlan and Sin-sabaugh, 1999) have shown that the best Z-R relationship depends significantly on geographic location. The ROC is recommending separate Z-R relationships for Eastern and Western U.S. locations.

Selecting the appropriate Z-R relationship should improve radar rainfall estimates. However, several other factors can limit or degrade the performance of the PPS. Sites should be aware of these factors:

- The radar must be well calibrated to provide consistent accurate rainfall estimates.
- Stratiform and orographic precipitation are generally shallow with a fairly steep vertical reflectivity gradient. This will cause the radar beam to sample rain more poorly with increasing range in stratiform events when compared with convective rainfall, and will significantly shorten the effective range for reliable rainfall estimates.
- A "bright band" will cause areas of overestimation in PPS products.
- Cool season stratiform Z-R relationships enhance rainfall estimates from lower reflectivity values (see Table 8-3), so clutter contamination may appear more prominent in cool season stratiform events than in other stratiform or convective events.

Table 8-3. Recommended Z-R Relationship					
Reflectivity	WSR-88D Convective ( $Z=300R^{1.4}$ )	Rosenfeld Tropical ( $Z=250R^{1.2}$ )	Marshall- Palmer ( $Z=200R^{1.6}$ )	East-Cool Stratiform ( $Z=130R^{2.0}$ )	West-Cool Stratiform ( $Z=75^{2.0}$ )
15 dBZ	<0.01 in/hr	<0.01 in/hr	0.01 in/hr	0.02 in/hr	0.03 in/hr
20 dBZ	0.02 in/hr	0.02 in/hr	0.03 in/hr	0.04 in/hr	0.05 in/hr
25 dBZ	0.04 in/hr	0.05 in/hr	0.05 in/hr	0.06 in/hr	0.08 in/hr
30 dBZ	0.09 in/hr	0.13 in/hr	0.11 in/hr	0.11 in/hr	0.14 in/hr
35 dBZ	0.21 in/hr	0.33 in/hr	0.22 in/hr	0.19 in/hr	0.26 in/hr
40 dBZ	0.48 in/hr	0.85 in/hr	0.45 in/hr	0.35 in/hr	0.46 in/hr
45 dBZ	1.10 in/hr	2.22 in/hr	0.93 in/hr	0.61 in/hr	0.81 in/hr
50 dBZ	2.50 in/hr	5.80 in/hr	1.91 in/hr	1.09 in/hr	1.44 in/hr
55 dBZ	5.68 in/hr	15.14 in/hr	3.93 in/hr	1.94 in/hr	2.56 in/hr
60 dBZ	12.93 in/hr	39.53 in/hr	8.07 in/hr	3.45 in/hr	4.55 in/hr

Sites should be aware that changes to the PPS Z-R relationship can directly and significantly impact NWS River Forecast Center (RFC) operations and products. Please coordinate with and/or notify any RFCs that use your PPS products whenever your site changes these parameters.

#### References:

Cairns, M., A. Huggins, and S. Vasiloff, 1998: Precipitation Algorithm improvements in the Eastern Sierra. *NWS Western Region Technical Attachment No. 98-08*, Salt Lake City, UT, 5 pp.

Huggins, A., and D. Kingsmill, 1998: Improvements of WSR-88D Algorithms in the Intermountain West with Applications to Flash Flood Forecasts and Wintertime QPFs. *CIASTA Annual Report on Progress under Task II: Weather Research*. Desert Research Institute, Dandini Research Park, Reno, NV, 26 pp.

Marshall, J. S., W. Hitschfeld, and K. L. S. Gunn, 1955: Advances in radar weather. *Adv. Geophys.* 2, 1-56.

Quinlan, J. S. and E. J. Sinsabaugh, 1999: An evaluation of the performance of the Snow Algorithm at NWFO Albany, NY during the 1997-98 Winter Season. *29<sup>th</sup> Conf. on Radar Meteor.*, Montreal, Quebec, Canada, Amer. Meteor. Soc., 794-797.

Rosenfeld, D., D. B. Wolff, and D. Atlas, 1993: General probability-matched relations between radar reflectivity and rain rate, *J. Appl. Meteor.*, 32, 50-72.

Super, A. and E. Holroyd III, 1998: Snow accumulation algorithm for the WSR-88D radar, Final Report. *Bureau of Reclamation Report R-98-05*, Denver, CO, 75 pp.

Name	Value	Range
Max Precipitation Rate [MXPRA]	103.8	50.0 <= x <= 1600.0, mm/hr
Z-R Multiplier Coef. [CZM]	300.0	30.0 <= x <= 3000.0, coefficient
Z-R Exponent Coef. [CZP]	1.4	1.0 <= x <= 2.5, factor

Figure 8-5. Algorithms - Hydromet Rate

## **8.7 MDA**

The Mesocyclone Detection Algorithm (MDA) has been designed as a warning decision tool for operational forecasters (Figure 8-6). The MDA uses radial velocity and reflectivity data to detect storm-scale (1-10 km) cyclonic vortex signatures and diagnose attributes of the detected signatures to determine if they are associated with tornadoes and/or damaging wind. There are three parameters that are URC LOCA adaptable. The MDA does not replace the Mesocyclone Algorithm and that alerts are not based on MDA output.

### **8.7.1 Minimum Reflectivity**

The minimum reflectivity threshold removes velocity data from MDA analysis when the velocity data comes from a bin in which the reflectivity is too small. The goal is to make sure that MDA evaluates velocity values from storms, not clear air. The default minimum reflectivity value is 10 dBZ with an allowable range of -25 dBZ to 35 dBZ.

This parameter affects all MDA output. The algorithm uses this reflectivity value as a minimum threshold that must be met in order for the corresponding radial velocity data to be processed in its search for cyclonic circulations. A setting of -25 dBZ will process all velocity data bins while a setting of 30 dBZ will process only those bins producing precipitation.

Field personnel need not change this parameter unless clear air false alarms cause problems.

### **8.7.2 Overlap Display Filter**

The Overlap Display Filter is the Boolean value that allows a user to turn on the algorithm based overlap display filter. The overlap display filter eliminates the display of 3D features that overlap lower elevation features; default TRUE, range TRUE to FALSE. This display filter reduces clutter and allows more important, lower elevation features to be displayed.

This parameter affects only the MD product. When set to YES, elevated circulations that overlap a circulation at a lower elevation will not be included in the product. When set to NO, all features meeting the MINIMUM DISPLAY FILTER RANK parameter will be included in the MD product.

Field personnel need not change this parameter because AWIPS plans on implementing this filter on the display device.



### **8.7.3 Minimum Display Filter Rank**

The Minimum Display Filter Rank is the minimum strength rank below which the 3D features are marked not to be displayed; default 5, range 1 to 5, precision: 1. This display filter reduces clutter and eliminates less important, weaker features from being displayed.

This parameter affects only the MD product. The algorithm uses this strength rank as a minimum threshold that must be met in order for a circulation to be included in the MD product. Research has shown that a value of 5 for this parameter results in circulations included in the MD product closely matching the circulations in the legacy M product. A value lower than 5 will increase the number of lower strength rank features in the MD product.

Field personnel need not change this parameter because AWIPS plans on implementing this filter on the display device. This display filter serves only as a backup filter in the event the AWIPS filter does not get implemented.

Close

Save

Undo

Baseline:

Restore

Update

Adaptation Item

MDA

Value

Range

Minimum Reflectivity	0	-25 <= x <= 35, dBZ
Overlap Display Filter	Yes	No, Yes
Minimum Display Filter Rank	5	1 <= x <= 5

Figure 8-6. Algorithms - MDA

## **8.8 Mesocyclone**

When non-traditional supercell mesocyclones are forecast or observed, operators should consider reducing the Mesocyclone algorithm adaptable parameter TPV. (TPV defines the minimum number of pattern vectors contained in a 2D Feature.) At smaller values of TPV, the Mesocyclone algorithm should produce more detections on smaller features. However, this change may also generate more false alarms. If the change has a detrimental effect on the Mesocyclone algorithm's performance, return the adaptable parameter setting to its original value of 10.

### **8.8.1 Delegated URC Authority**

The ROC has authorized field personnel to change the TPV adaptable parameter in the Mesocyclone algorithm. See [Figure 8-7](#).

The default value of TPV is set at 10. Sites may change the value of TPV from 10 to lower values, but not lower than 6.

### **8.8.2 Supplemental Information - Mesocyclone**

For additional information, refer to the following papers:

Burgess, D. W., R. J. Donaldson, T. Sieland, and J. Hinkelman, 1979: Final Report on the Joint Doppler Operational Project (JDOP 1976 - 1978). Part 1: Meteorological Applications. NOAA Tech. Memo. ERL NSSL-86, NOAA, Boulder CO, 84 pp. [NTIS PB80-107/88/AS.]

Burgess, D. W., R. J. Donaldson, and P.R. Desrochers, 1993: Tornado detection and warning by radar. The Tornado: Its Structure, Dynamics, Prediction, and Hazards, Geophys. Monogr., No. 79, Amer. Geophys. Union, 203-221.

Desrochers, P. R. and R. J. Donaldson Jr., 1992: Automatic tornado prediction with an improved mesocyclone-detection algorithm. Wea. Forecasting, 7, 373-388.

Doswell, C. A., III, R. Jones, and D. L. Keller, 1990: On summary measures of skill in rare event forecasting based on contingency tables. Wea. Forecasting, 5, 576-585.

Lee, R. R., and A. White, 1998: Improvement of the WSR-88D Mesocyclone Algorithm. Wea. Forecasting, 13, 341-351.

Zrnic, Dusan S, D.W. Burgess, T. Gal-Chen, 1984: Automatic Detection of Mesocyclonic Shear: Test Results, 22nd Conference on Radar Meteorology, 10-13 September, 1984, Zurich Switzerland, Amer. Meteor. Soc., 160 - 165.

Close

Save

Undo

Baseline:

Restore

Update

Adaptation Item

Mesocyclone

Algorithms

Name

Value

Range

Min # Pattern Vectors [TPV]

10

1 <= x <= 20

Figure 8-7. Algorithms - Mesocyclone

### 8.9 Snow Accumulation

The Snow Accumulation Algorithm (SAA) provides estimates of accumulated snow water equivalent (SWE) and snow depth (SD). While the algorithm is fully incorporated into the RPG software, AWIPS currently can not display the products (scheduled for AWIPS OB6, August 2005), whereas OPUP is able to display the products.

The SAA uses reflectivity from the Enhanced Preprocessing (EPRE) algorithm. The EPRE reflectivity is a terrain-based hybrid scan which has had clutter removed by the Radar Echo Classifier (REC) algorithm. If the beam blockage or likelihood of AP/Clutter exceeds adaptable thresholds, reflectivity information from a higher elevation is used. The EPRE also adjusts (or adds) power for partial beam blockage.

Whenever a hybrid scan of reflectivity data is available from the EPRE, SAA processes the data. During periods of no observed snow, the algorithm accumulates bogus snow totals from non-snow returns. Since the SAA does not have a precipitation detection function, the SAA does not automatically reset SAA accumulations at the beginning of a snowstorm or stop accumulating (e.g., reset SAA snow accumulations) at the end of a snowstorm.

#### NOTE

The user must manually reset algorithm accumulations. It is recommended that accumulations be reset at the beginning of a storm after snow has started to reach the ground. Resetting accumulations to zero can be accomplished at the RPG HCI. Resetting accumulations affects all snow products.

During each volume scan, the SAA filters incoming reflectivity data using maximum and minimum reflectivity thresholds to further mitigate contamination from isolated reflectivity values that are likely not dry snow. Reflectivity values below an adaptable minimum reflectivity threshold are not considered to be snow and are ignored. Light snow can sometimes result in reflectivity below the minimum reflectivity threshold, but accumulation rates observed with below threshold reflectivities are extremely light. Reflectivity values above a maximum reflectivity threshold are either set to the average reflectivity of its neighbors if the sample volume is not isolated or set to no data if the sample volume is isolated. Isolated sample volumes have no neighbors with reflectivity values above the minimum reflectivity threshold.

Reflectivities are converted to an estimate of SWE rate using a Z-S relationship. A range/height correction is applied to each point based on the height of the beam at each point. Above a minimum threshold height, SWE rate is multiplied by a range/height correction factor to mitigate underestimation caused when the radar beam begins to overshoot the precipitation or due to the lack of beam filling. The range/height correction increases with height and is computed from a second order polynomial.

To compute accumulations over time, each volume scan's SWE rates are multiplied by the time span between volume scans producing a scan-to-scan SWE accumulation. The scan-to-scan SWE accumulations are multiplied by the snow ratio resulting in scan-to-scan SD accumulations. SWE and SD scan-to-scan accumulations are accrued over different accumulation periods.

SWE and SD products are available for different accumulation periods, including 1-hour, user-selectable, and storm total products. All products have a maximum range of 230 km and a resolution of 1km. During algorithm development and in other work, a high degree of variability has been observed with snow - radar measurements in shorter time intervals (such as Z-S relationships within an hour). Accordingly, the SAA performance over small time intervals (such as 1-hour) is not as good as longer time intervals (such as storm totals).

The 1-hour SWE and SD products (One-hour Snow Accumulation (Water Equiv.) (OSW) and One-hour Snow Accumulation (Depth) (OSD), respectively) are the accumulation over about the past hour, and the accumulations are updated every volume scan. For the 1-hour product, accumulations must exist for an adaptable minimum time threshold before the 1-hour accumulation is available. As a result, after an accumulation reset, the 1-hour accumulation will not be available until the minimum time threshold has passed.

The user selectable SWE and SD products (User Selectable Snow Accumulation (Water Equiv.) (USW) and User Selectable Snow Accumulation (Depth) (USD), respectively) are accumulations over a user-defined number of whole hours ending on a user-defined hour of the day (UTC). The user selectable accumulations are made up top-of-the-clock-hourly accumulations. The user selectable accumulations are updated once an hour after the top of the hour. Top-of-the-clock-hourly accumulations must be available for at least two-thirds of the user-defined number of hours before the user-selectable accumulations are available. For example, if a user defines a USW for six hours, there must be at least four top-of-the-clock-hourly accumulations available before the accumulations appear on that USW.

The storm total SWE and SD products (Storm Total Snow Accumulation (Water Equiv.) (SSW) and Storm Total Snow Accumulation (Depth) (SSD), respectively) are accumulations since the accumulations have been reset. The storm total accumulations start the volume scan after the reset.

The algorithm was developed for and its adaptable parameters have been optimized for dry snow, or snow that is not melting while falling or on the ground. The algorithm does not account for bright band effects from falling wet snow. When and where a bright band occurs, the SAA tends to overestimate when compared to snowfall that was subject to melting below the radar beam, including on the ground. SD estimates are impractical for old and/or wet snow or when ground temperatures are above freezing.

Near a major winter storm, there are often areas receiving dry snow, wet snow, mixed precipitation, and rain, all within range of the same radar. SAA is not able to partition the products into areas with different precipitation types; therefore, in cases where dry snow covers only part of the radar umbrella, users of snow depth products must be cognizant of when and where dry snow is occurring.

If the areas of snow and rain did not change location, it would be relatively easy to keep track of which area contained snow and have useful SAA estimates. However, if the areas of rain and snow are changing, it would be unrealistic to keep track of the areas containing snow, and, in those cases, SAA estimates should be used with caution.

The SAA does not account for advection of snow during the snow's descent from the radar beam to the ground. Attempts to account for advection added little skill to SAA.

Due to the low-topped nature of snowstorms, the SAA is subject to underestimation. The range/height correction scheme extends the useful range to, at most, 150 km when the hybrid scan is using the lowest elevation scan. For areas where the lowest elevation scan is blocked at close range and for mountain top radars, the SAA's effective range may be less than 150 km.

The SAA can not discriminate between reflectivities representing dry snow reaching the ground and representing other targets. Therefore, the other targets will be included in SAA estimates resulting in overestimates or bogus estimates. Some common examples are virga, rain, birds, chaff, terrain, and ground clutter residue. In order to eliminate these bogus accumulations and have realistic storm total accumulations, the user must reset SAA accumulations when snow begins reaching the ground. However, a hybrid scan can contain reflectivities representing both snow reaching the ground and representing other targets at the same time. For example, snow does not begin reaching the ground at the same time throughout the radar umbrella. After an accumulation reset, areas where snow has not yet reached the ground may be rain or virga, which SAA will add to accumulation estimates. After an accumulation reset, all previous accumulations will be erased.

A maximum reflectivity threshold is used to filter high reflectivities which usually are not dry snow. However, in rare cases, reflectivities greater than the maximum reflectivity

threshold have been observed with heavy snow. In these cases, the SAA tended to underestimate snow.

Reliable snow measurements (such as trained spotter reports), if available, should be used in conjunction with SAA products to validate and calibrate the algorithm estimates. However, snow measurements (such as gages and snow reports) are full of potential errors (such as drifting and under-catch). Therefore, when comparing SAA estimates with measurements, one should take great care to ensure the quality of the snow measurements. If no reliable and timely snow measurements are available, snow products may be the only or best source of snow estimates. For example, during a severe snow-storm, spotters may be unable to take accurate regular measurements and report them in a timely manner, or spotters may not be directly under the echoes of interest (such as the heaviest snow band).

The SAA has seven URC-level adaptable parameters. For all seven of these adaptable parameters, optimum settings were derived for different regions of the US using data from one representative site within that region. The adaptable parameters were optimized for best overall performance throughout a winter season. The seven URC adaptable parameters are described in the following paragraphs and in Table 8-4.

SAA uses a Z-S relationship in the form of  $Z = \alpha S^\beta$  to convert reflectivity to a rate of snow water equivalent, where  $\alpha$  is the Multiplicative Coefficient and  $\beta$  is the Power Coefficient. Default regional settings can be found in the Regional Default Adaptable Parameters Table (see Table 8-4). If the default Z-S relationship results in inaccurate estimates, sites can change the relationship.

### **8.9.1 Z-S Multiplicative Coefficient**

The range of values for the Z-S Multiplicative Coefficient ( $\alpha$ ) are 10.0 to 1000.0 (no units). Decreasing the Multiplicative Coefficient in the Z-S relationship increases accumulation rates. Likewise, increasing the Multiplicative Coefficient in the Z-S relationship decreases accumulation rates. The default values are found in the Regional Default Adaptable Parameters Table (see Table 8-4).

### **8.9.2 Z-S Power Coefficient**

The range of values for the Z-S Power Coefficient ( $\beta$ ) are 1.00 to 3.00 (no units). Decreasing the Power Coefficient in the Z-S relationship increases the slope of the increase in accumulation rates with greater reflectivity. Likewise, increasing the Power Coefficient in the Z-S relationship decreases the slope of the increase in accumulation rates with greater reflectivity. The default values are found in the Regional Default Adaptable Parameters Table (see Table 8-4).



### 8.9.3 Snow - Water Ratio

The range of values for the Snow-Water Ratio are 4.0 to 100.0 (in/in). The Snow-Water Ratio is the number of inches of snow depth per inch of snow water equivalent (snow - water ratio is the inverse of snow density). The SAA uses this ratio to convert SWE estimates to SD estimates. Changes to this parameter are not retroactive. The default value (determined during algorithm development) should be used unless your site has a reliable method for forecasting the snow-water ratio for an event. The default values are found in the Regional Default Adaptable Parameters Table (see Table 8-4).

Although snow ratios for fresh dry snow can vary from 4:1 to 100:1, median snow ratios at most U.S. location vary from 11:1 to 17:1, regardless of latitude and elevation (Doesken and Judson 1996). The NWS Forecast Office near Minneapolis, MN measured snow ratios of 30:1 or more during arctic outbreaks (Rich Naistat, NWSFO Twin Cities, MN and Dave Bernhardt, NWSFO Great Falls, MT, personal communication). The NWS Forecast Office in Albany, NY measured snow ratios of 17:1 for a lake effect snow, 12.5:1 for pure synoptic scale snow, and 10:1 for snow mixed with graupel or sleet (Quinlan and Sinsabaugh 1999). Since the snow ratio can vary greatly in time and space, users should use caution in changing the snow ratio during a snowstorm based on in situ measurements. Algorithm developers found hourly snow ratios varied greatly and were a poor forecast of the next hour's snow ratio. In addition, much care was taken to remove wet snow data from the data sets used in development studies.

### 8.9.4 Minimum Height Correction

The range of values for Minimum Height Correction are 0.01 through 20.00 (km). SAA has a simple range/height correction that mitigates underestimation as a function of height. To apply the correction to a range bin (from the hybrid scan), the range bin must be above the Minimum Height Correction threshold. The default values are found in the Regional Default Adaptable Parameters Table (Table 8-4). Changes to the Minimum Height Correction should be done in conjunction with changes to the Range Height Correction Coefficients.

### 8.9.5 Range Height Correction Coefficients

If a sample volume is not from the 0.5 degree elevation scan, the sample volume is first projected to a range where the threshold base elevation angle intersects the sample volume's height. Next, a correction factor is computed based on the projected range as follows:

Correction factor =  $RC1 + RC2 * \text{projected\_range} + RC3 * (\text{projected\_range}^2)$ .

The three adaptable parameters, RC1, RC2, and RC3, are called the Range Height Correction Coefficients. As a result, the correction factor is a polynomial which increases with projected range.

Changes to the Range Height Correction Coefficients should be based on local studies of gages versus radar estimates with range. To change the correction factor, a new equation should be determined, rather than adjusting just one value. In addition, changes to the Range Height Coefficients should be done in conjunction with a change to the Minimum Height Correction. The Range Height Correction Coefficients are discussed below.

### 8.9.6 Range Height Correction Coefficient #1

The range of values for Coefficient #1 are -5.0000 through 5.0000 (no units). The default values of the coefficients are found in the Regional Default Adaptable Parameters Table (see Table 8-4). Increasing this coefficient increases the correction factor applied to snow estimates at all ranges.

### 8.9.7 Range Height Correction Coefficient #2

The range of values for Coefficient #2 are -5.0000 through 5.0000 (no units). The default values of the coefficients are found in the Regional Default Adaptable Parameters Table (see Table 8-4). Increasing this coefficient increases the correction factor applied to snow estimates, and the increase is equal to the coefficient multiplied by the projected range.

### 8.9.8 Range Height Correction Coefficient #3

The range of values for Coefficient #3 are -5.0000 through 5.0000 (no units). The default values of the coefficients are found in the Regional Default Adaptable Parameters Table (see Table 8-4). Increasing this coefficient increases the correction factor applied to snow estimates, and the increase is equal to the coefficient multiplied by the projected range squared.

Table 8-4. Regional Default Adaptable Parameters

US Region	Z-S Multiplier Coefficient, $\alpha$	Z-S Power Coefficient, $\beta$	Snow Water Ratio (in/in) <sup>1</sup>	Range / Height Correction Coefficients	Minimum Height Correction Threshold (km)
Northeast	120	2.0	11.8	#1 = 0.8414, #2 = 0.0040, #3 = 0.0	0.45
Great Lakes	180	2.0	16.7	#1 = 0.8414, #2 = 0.0040, #3 = 0.0	0.45

Table 8-4. Regional Default Adaptable Parameters - Continued

US Region	Z-S Multipli- cative Coeffi- cient, $\alpha$	Z-S Power Coefficient, $\beta$	Snow Water Ratio (in/in) <sup>1</sup>	Range / Height Correction Coefficients	Minimum Height Correction Threshold (km)
N. Plains/Upper Midwest	180	2.0	11.8	#1 = 1.0970, #2 = 0.0069, #3 = 0.0	0.40
High Plains	130	2.0	13.3	#1 = 1.0970, #2 = 0.0069, #3 = 0.0	0.40
Inter-mountain West	40	2.0	14.3	#1 = 0.3580, #2 = -0.0020, #3 = 0.0003	0.60
Sierra Nevada	222	2.0	8.0	#1 = 2.4371, #2 = -0.0640, #3 = 0.0007	0.60

<sup>1</sup> - Snow ratio for Lake Effect snow is 20.0, for synoptic scale snow is 13.0, and for arctic outbreaks is 30.0

Close

Save

Undo

Baseline:

Restore

Update

Algorithms

Adaptation Item

Snow Accumulation

Name	Value	Range
Z-S Multiplicative Coefficient	120.0	10.0 <= x <= 1000.0
Z-S Power Coefficient	2.0	1.00 <= x <= 3.00
Snow - Water Ratio	11.8	4.0 <= x <= 100.0, in/in
Minimum Height Correction	0.45	0.01 <= x <= 20.00, km
Range Height Correction Coefficient #1	0.8414	-5.0000 <= x <= 5.0000
Range Height Correction Coefficient #2	0.004	-0.5000 <= x <= 0.5000
Range Height Correction Coefficient #3	0.0	-0.5000 <= x <= 0.5000

Figure 8-8. Snow Accumulation

## 8.10 Storm Cell Components

The Storm Cell Components algorithm is the part of the Storm Cell Identification and Tracking (SCIT) algorithm which identifies storm cells and their components. The largest difference between the SCIT algorithm and the Storm Series algorithms is that instead of defining the volume of convective storms, this algorithm identifies the individual high reflectivity cores or cells within convective storms. The SCIT algorithm's ability to identify and track cells within a larger area of significant reflectivity (e.g. squall line) is significantly improved over the Storm Series legacy algorithm package. However, SCIT will still have difficulty identifying (and tracking) cells if a large area of significant reflectivity is nearly constant with no substantial reflectivity maximum, as in a uniform squall line or a stratiform area of moderate to heavy rain. See [Figure 8-9](#).

### 8.10.1 Overview of SCIT

First, to identify cells, the algorithm combines segments (from the Storm Cell Components algorithm) into two-dimensional potential components. The segments must overlap radially by at least the Segment Overlap Threshold (2 bins) and be on adjacent radials which are less than the Azimuth Separation Threshold (1.5 degrees) apart. Since there are multiple reflectivity thresholds used to find segments, only segments found on the same elevation scan with the same reflectivity threshold are combined. The Max Pot Comps/Elv Threshold (70 storm components) is the maximum number of potential components which can be saved per reflectivity threshold per elevation scan. The potential component is labeled a component if it has a minimum of at least the # Segments/Comp Threshold (2 storm segments) and has a minimum area of Component Area Threshold ( $10.0 \text{ km}^2$ ) for its reflectivity threshold. Next, a search is done for overlapping components of different reflectivity thresholds on the same elevation scan to identify centroids. A centroid is the mass-weighted center of a component or cell. If the centroid of a component found with a higher reflectivity threshold falls within the boundaries of another component, the component found with the higher reflectivity threshold is saved, and the other is discarded. After this process, the Max Comps/Elev Threshold value (120 components) is the final number of components per elevation scan which can be saved.

Then the components are vertically correlated, i.e. assigned to the same cell. The centroids of the components at adjacent elevation scans are compared for horizontal proximity. For each component, the distance from the center of every component in the next highest elevation scan is compared until a component is found within a specified Search Radius Threshold #1 (5.0 km). If no match is found for a component, then the search radius is increased to the Search Radius #2 Threshold (7.5 km), and the comparison is done again. This process is repeated, if necessary, with Search Radius Threshold #3 (10.0 km). At this point, the Max Detected Cells

Threshold (130 storm cells) is the maximum number of cells saved (in a volume scan).

If two cells' centroids are within spacial proximity, the cells are merged. To merge two cells, their centroids must be within the specified Horizontal Merge Distance Threshold (10.0 km), and their bases and tops must be within the specified vertical and angular Height Merge Threshold (4.0 km) and Elevation Merge Threshold (3.0 degrees), respectively. When merging two cells, one cell's components are added to the other cell, and a new centroid is calculated. Next, to reduce the crowding, when two cells are still within spacial proximity, the cell with the lesser Cell based VIL is deleted. To delete one of the cells, either of their centroids must be no more than the Horizontal Delete Threshold (5.0 km) apart. Or, the difference in their cell depths must be greater than the Depth Delete Threshold (4.0 km), and their centroids must be no more than twice the Horizontal Delete Threshold (5.0 km) apart. The final maximum number of cells (after the merging and deletion processes) in a volume scan is the Max Cells/Volume Threshold (100 storm cells).

#### **8.10.2 Maximum Cell Based VIL Threshold**

The Maximum Cell Based VIL Threshold value (120 kg/m<sup>2</sup>) is the maximum Cell based VIL which will be computed or displayed. The Cell based VIL is an estimate of the liquid water through a storm cell, based on the cell's component's maximum reflectivities. The purpose of the Maximum Cell Based VIL Threshold is to mitigate hail contamination of the Cell based VIL. However, since the Cell based VIL can be used as a hail predictor, the default value is set at its maximum value. The value can be lowered to prevent extremely high Cell based VILs due to hail contamination.



Figure 8-9. Algorithms - Storm Cell Components

### **8.11 Storm Cell Tracking**

The Storm Cell Tracking algorithm monitors the movement of storm cells as part of the SCIT algorithm suite. Although the SCIT algorithm suite exhibits significant tracking and forecast skill, cell mergers/splits and rapid cell decay/growth may not be handled well.

The first step is matching storms found in the current volume scan to the storm cells from the previous volume scan in time and space. The second step is to forecast their movement. [Figure 8-10](#) displays the Storm Cell Tracking window.

The storm cells are matched as follows. Starting with the most intense cell (i.e. largest Cell based VIL value) in the current volume scan, the centroid position is compared to the projected centroid positions of cells from the previous volume scan. A cell's projected centroid position is its forecasted position for the current volume scan. The cell from the previous volume scan with a projected centroid located within a distance computed from the Correlation Speed which is closest to the current cell is correlated. When a cell is correlated, it is considered the same cell and assigned the same storm cell ID. Then, the next most intense cell in the current volume scan is compared to all uncorrelated cells in the previous volume scan, and so on, until all cells in the current volume scan are processed. Once a cell from the previous volume scan is correlated, it is not compared to any more cells in the current volume scan. If no projected centroid positions are within the adaptable range of a cell's centroid position, the cell remains uncorrelated and is assigned a new storm cell ID. If a time period of more than Time (Maximum) has passed between the current and past volume scans, then no matching is done, and all storms in the current volume scan are considered new. The centroid positions used are in a Cartesian coordinate system with the radar at the origin, and where the X-axis denotes east-west directions and the Y-axis denotes north-south directions.

The forecast of a storm cell's movement is based on the cell's movement over its lifetime, for up to the Number of Past Volumes, including the current volume scan. The first time a storm cell is detected it is labeled new. In this case, no prediction of movement is made, and the cell is assigned a vector average storm motion of all cells in the previous volume scan (or the default storm motion if no storm cells previously existed. After the first volume scan a storm cell is detected, a forecast movement is computed based on a linear least squares extrapolation of its previous movement. Forecast positions are computed in time steps equal to the Forecast Interval. The number of forecast positions, or Number of Intervals, computed for a cell depends upon the scaled forecast error and the permissible error. The scaled forecast error is the accuracy of the previous volume scan's forecast (or forecast error) scaled by the ratio of the Error Interval over the time between volume scans. The permissible error is the Allowable Error scaled by the Error Interval over the length (in time) of the forecast (for this Forecast Interval). Basically, the poorer a forecast was for a cell for the past volume scan, the fewer the number of forecast posi-



tions. For display purposes only, if a storm cell's forecasted movement is less than the Thresh (Minimum Speed), then no past and forecast positions are graphically displayed. In this case, the cell's movement is displayed as a centroid symbol with a concentric circle (at the current position).

Close

Save

Undo

Baseline:

Storm Cell Tracking

Algorithms

Restore

Update

Adaptation Item

Storm Cell Tracking

Range

Name	Value	Range
Default (Direction)	225	0 <= x <= 360, degrees
Default (Speed)	25.0	0.0 <= x <= 99.9, knots

Figure 8-10. Algorithms - Storm Cell Tracking

## **8.12 Tornado Detection**

The Tornado Detection Algorithm (TDA) is the replacement for the Tornadic Vortex Signature (TVS) algorithm. The TDA is designed to search base velocity data to identify intense circulations which are producing or about to produce tornadoes. The output from this algorithm is used to build the TVS product. The circulations identified by the TDA are called TVSs (and ETVSs) as in the old TVS Algorithm. See Figure 8-11.

The TDA adaptable parameters were determined from studies on a large, geographically diverse data set of tornadic events. These studies were conducted by persons from NWS forecast offices, the NSSL, and the ROC. During TDA's development, the algorithm's performance and the default parameters were considered optimized when the Critical Success Index (CSI) was highest. Using default adaptable parameter values and an independent data set, Mitchell et al. (1998, Weather and Forecasting) showed the TDA to have a POD = 0.43, an FAR = 0.48, and a CSI = 0.31. Comparison studies by Mitchell (28th Conference on Radar Meteorology, A Performance Evaluation in Comparison of the NSSL Tornado Detection Algorithm and the WSR-88D Tornadic Vortex Signature algorithm, 1997) showed that the old TVS Algorithm with optimized adaptable parameters had a POD = 0.43, an FAR = 0.48, and a CSI = 0.31.

### **8.12.1 Delegated URC Authority**

Most adaptable parameters for the Tornado Detection Algorithm (TDA) are ROC LOCA. There are, however, six URC LOCA adaptable parameters. Each of them are described in the paragraphs below.

#### **8.12.1.1 Minimum Reflectivity Threshold**

The URC is authorized to change the Minimum Reflectivity Threshold parameter (Min Reflectivity) to any value between 0 and 20 dBZ (0 dBZ = default). Values below 0 dBZ are possible, but not recommended at this time. This adaptable parameter prevents identification of one-dimensional pattern vectors and, hence, any TVSs (or ETVSs) from any velocity sample volumes that do not also have a corresponding reflectivity of at least the threshold value. Increasing the value will eliminate TVS identifications in low reflectivity regions and, at the same time, decrease the amount of processing for the algorithm possibly helping to alleviate CPU load shedding. Therefore, a URC may increase the value (above 0 dBZ) if there are false alarm TVSs (or ETVSs) being identified in areas of low reflectivity which are clearly not tornadic storms. These false alarms may be found in shear regions such as sea breezes, gust fronts, and velocity dealiasing errors primarily close to the radar. Studies have shown that increasing the value (above 0 dBZ) will slightly decrease the TDA's overall performance. The Minimum Reflectivity Threshold

value should not be set below 0 dBZ. Parameter studies have shown that the number of false alarms increases as the reflectivity threshold is lowered below 0 dBZ.

#### **8.12.1.2 Maximum Pattern Vector Range**

The URC may change the Maximum Pattern Vector Range parameter (Max Pattern Vector Range) only to a value between 100 and 150 km (100 km = default), even though the window shows a range of Maximum Pattern Vector Range to be 0 - 230 km. One-dimensional pattern vectors and, hence, any TVSs (or ETVSs) can only be identified within this range. Decreasing this parameter to values less than 100 km limits the radar umbrella coverage for TVS detections. Increasing the parameter will extend the algorithm's processing range and processing load (or CPU at the RPG). The default value (of 100 km) was determined from a diverse set of cases. And, overall, when the range is extended, algorithm performance decreases due to beam broadening and increasing beam height. Also, at longer distances, there is a greater likelihood of range folding and dealiasing errors which decrease algorithm performance. However, in cases with very strong, tall tornadic storms, performance does not decrease when the range is extended. Therefore, a URC may increase the value up to 150 km to extend the TDA processing range.

#### **8.12.1.3 Maximum Number of Elevated TVS's**

The Maximum Number of Elevated TVS's (Max # Elevated TVS's) represents the maximum number of ETVS's that the algorithm can process per volume scan. This parameter permits the detection of more or fewer elevated TVS's. Since statistical studies on ETVS were not complete at the time of Build 10 release, the default value of Maximum # of Elevated TVS's was set to zero. With a default value of 0, this parameter stops TDA from identifying ETVS's; and the ETVS detections are not placed on the Combined Attribute Table. If users decide to generate ETVS's, with a value greater than 0, ETVS's will be placed in the Combined Attribute Table and users will receive ETVS information. If ETVS's are generated at the RPG, users will have to change an adaptable parameter (Display ETVS's Yes or No?) from a default value of No to a value of Yes to display the ETVS detections on associated users' windows.

### **8.12.2 Adaptable Parameter Sets**

TDA uses 25 adaptable parameters to specify program memory limits, modify data processing thresholds, and establish criteria for detecting 2D (2-dimensional) and 3D vortex features. Three of these 25 adaptable parameters filter 3D vortices by depth and gate-to-gate velocity difference. The three parameters are:

- **MIN 3D FEATURE DEPTH (Depth)**

Minimum depth required to declare a TVS or an ETVS. Depths of 3D circulations may vary according to expected storm type. Also, studies show that the majority of tornadic circulations meet or exceed 1.5 km depth. However, the operator may want to lower this value in cases of very low topped tornadic convection. Large values may result in a lower probability of detection. Small values may result in an increased number of false detections.

The Minimum 3D Feature Depth parameter is modifiable by the URC; however, the value used can only be used in specific combination with the other adaptable parameters (LLDV and MDV) that define the meteorologically classified adaptable parameter sets: Default Set, Minimized Set, Isolated Supercell Set, and Squall Line and Other Set).

- **MIN 3D FEAT LOW-LVL DELTA VEL (LLDV)**

Minimum radial velocity difference in the lowest 2D Feature within a 3D Feature required to identify a TVS or ETVS. Allows freedom to consider weaker circulations or consider only the stronger circulations based upon expected type of events (e.g. supercells, squall line, bow-echo, etc.). Lower values allow the detection of tornadic circulations in their incipient stages. Additionally, lower values will allow weaker circulations to be processed, however, this could result in a higher false alarm rate.

The Minimum 3D Low-Level Delta Velocity parameter is modifiable by the URC; however, the value used can only be used in specific combination with the other adaptable parameters (MDV and Depth) that define the meteorologically classified adaptable parameter sets: Default Set, Minimized Set, Isolated Supercell Set, and Squall Line and Other Set).

- **MIN TVS DELTA VELOCITY (MDV)**

Minimum radial velocity difference of the maximum 3D Feature delta velocity required to declare a TVS. See MIN 3D FEAT LOW-LVL DELTA VEL.

The Minimum TVS Delta Velocity parameter is modifiable by the URC; however, the value used can only be used in specific combination with the other adaptable parameters (LLDV and Depth) that define the meteorologically classified adaptable parameter sets: Default Set, Minimized Set, Isolated Supercell Set, and Squall Line and Other Set).

The LLDV (Low Level Delta Velocity) parameter value specifies the minimum gate-to-gate velocity difference allowed at the lowest elevation angle in a 3D vortex. The MDV (Minimum TVS Delta Velocity) parameter value specifies the minimum gate-

to-gate velocity difference anywhere within a 3D vortex. (The TDA requires the LLDV value or the MDV value to be greater than a specified threshold to identify a TVS signature.) The Depth parameter value specifies the minimum depth allowed for a 3D vortex to be identified as a TVS. By systematically adjusting the values of these three adaptable parameters, TDA performance was optimized for several convective data sets.

Scientists from the NSSL and the ROC analyzed 45 cases containing approximately 2500 volume scans (approximately 210 hours of radar data) representing 194 tornadoes from many different areas of the United States. The 45 cases were categorized by storm type (15 isolated supercell cases, 13 squall line cases, 11 mini-supercell, and 6 tropical storm cases). A composite data set was created by combining all the squall line and isolated supercell cases.

### 8.12.2.1 Default Adaptable Parameter Set

The default set of adaptable parameters (LLDV, MDV, and Depth) is recommended for general use. This parameter set is based on 28 cases (15 isolated supercell, 13 squall line) containing 131 tornadoes, a small sample. If the convective mode cannot be forecast or a mix of convective modes exist at the same time in the county warning area, this default parameter set is recommended for use. The URC is authorized to make the following changes:

#### DEFAULT ADAPTABLE PARAMETER SET

Depth = 1.5 km.

Minimum 3D Feature Low Level Delta Velocity (LLDV) = 25 m/s

Minimum TVS Delta Velocity (MDV) = 36 m/s.

These values of LLDV, MDV, and Depth are to be used only in this combination.

Algorithm performance:

POD = 0.32

FAR = 0.61

CSI = 0.21

Algorithm performance will vary, depending on the convective mode. Best performance will be observed with isolated supercells. Expect poorer performance when using this parameter set in squall lines, tropical storms, and mini-supercells.

### 8.12.2.2 Minimized Adaptable Parameter Set

Using default adaptable parameter values, the TDA will identify more TVS circulations than the pre-Build 10 TVS algorithm. Obviously, this will require a change of operational approach when using the TDA. The TVS algorithm rarely identified a TVS (i.e., low POD), but if a TVS was identified, then the cir-

ulation was likely tornadic or about to be (i.e., low FAR). When using default values, the Build 10 TDA may identify multiple TVSs in one storm cell. This should not be taken to mean that the storm cell in question is more likely tornadic than had a single detection been made. Forecasters should always use other information (e.g., knowledge of environment, reflectivity structure, spotter reports, etc.) to identify detections which are most likely associated with tornadoes. Forecasters, using the NSSL WDSS test platform for the last two years, have become accustomed to TDA and find its performance acceptable and much better than the pre-Build 10 TVS algorithm, in spite of the increased number of detections. See Figure 8-11.

The default parameter set and/or the new operational approach, may not be best for all users. Therefore, in addition to the default set, authority is given to URC's to use a Minimized Adaptable Parameter Set. URCs may use the Minimized Adaptable Parameter Set to make TDA perform similar to the pre-Build 10 TVS algorithm. When the Minimized Set is used, the TDA will identify TVSs only rarely (i.e. low POD, FAR, and CSI). The Minimized Adaptable Parameter Set is provided in case some sites want to make the TDA emulate performance of the pre-Build 10 TVS algorithm. This parameter set is based on 45 cases containing 194 tornadoes (all storm types). When selecting a minimized mode of operation, the URC is authorized to make the following changes:

**MINIMIZED ADAPTABLE PARAMETER SET**

Depth = 5.0 km.

Minimum 3D Feature Low Level Delta Velocity (LLDV) = 56 m/s

Minimum TVS Delta Velocity (MDV) = 74 m/s

These values of LLDV, MDV, and Depth are to be used only in this combination.

Algorithm performance:

POD = 0.02

FAR = 0.08

CSI = 0.02

**8.12.2.3 Isolated Supercell Adaptable Parameter Set**

The set of adaptable parameters (LLDV, MDV, and Depth) which optimized algorithm performance on the isolated supercell data set are recommended for use with isolated supercells. This parameter set is based on 15 cases containing 68 tornadoes, a small sample. The URC is authorized to make the following changes:

**ISOLATED SUPERCELL ADAPTABLE PARAMETER SET**

Depth = 3.1 km.

Minimum 3D Feature Low Level Delta Velocity (LLDV) = 27 m/s

Minimum TVS Delta Velocity (MDV) = 30 m/s

These values of LLDV, MDV, and Depth are to be used only in this combination.

Algorithm performance of the isolated supercell parameter set on isolated supercells:

POD = 0.43

FAR = 0.44

CSI = 0.32

### 8.12.2.4 Squall Line and Other Adaptable Parameter Set

The set of adaptable parameters (LLDV, MDV, and Depth) which optimized algorithm performance on the squall line data set are recommended for use in squall lines. This same parameter set is also recommended for use with tropical cyclones and mini-supercells. This parameter set is based on 30 cases (13 squall line, 11 mini-supercell, 6 tropical cyclone) containing 126 tornadoes, a small sample. The URC is authorized to make the following changes:

SQUALL LINE and OTHER ADAPTABLE PARAMETER SET

Depth = 1.6 km.

Minimum 3D Feature Low Level Delta Velocity (LLDV) = 27 m/s

Minimum TVS Delta Velocity (MDV) = 27 m/s

These values of LLDV, MDV, and Depth are to be used only in this combination.

Algorithm performance of the Squall Line parameter set on squall lines:

POD = 0.18

FAR = 0.77

CSI = 0.11

Expect poorer performance on tropical cyclones and mini-supercells. The shallow nature of these storm types preclude easy identification by a radar beam that broadens and bends upwards with range.

### 8.12.3 Supplemental Information - Tornado Detection

For additional information refer to the following material:

Lee and Mitchell, 1999: Performance of the WSR-88D Build 10 tornado detection algorithm: Development of optimal adaptable parameter sets. Submitted to the 15th International Conference on Interactive Information and Processing Systems for Meteorology, Oceanography, and Hydrology, In Press.

Mitchell E.D., M.A., Fresch, R.R., Lee, T.M. Smith, W.D. Zittel, 1998: The new NSSL tornado detection algorithm for the WSR-88D. Preprints, 14th International Conference on Interactive Information and Processing Systems for Meteorology, Oceanography, and Hydrology, Phoenix AZ, Amer. Meteor. Soc., 271 - 274.

Mitchell E.D., S.V. Vasiloff, G.J. Stumpf, A. Witt, M.D. Eilts, J.T. Johnson, K.W. Thomas, 1988: The National Severe Storms Laboratory tornado detection algorithm. Weather and Forecasting, Vol. 13, No. 2, pp.352 - 366.

Mitchell E.D., 1997: A Performance Evaluation in Comparison of the NSSL Tornado Detection Algorithm and the WSR-88D Tornadic Vortex Signature Algorithm, Preprints, 28th Conf. on Radar Meteorology, Austin TX, Amer. Meteor. Soc., 351 - 352.

Name	Value	Range
Min Reflectivity	0	-20 <= x <= 20, dBZ
Max Pattern Vector Range	100	0 <= x <= 230, km
Min 3D Feature Depth	1.5	0.0 <= x <= 5.0, km
Min 3D Feat Low-Lvl Delta Vel	25	0 <= x <= 100, m/s
Min TVS Delta Velocity	36	0 <= x <= 100, m/s
Max # Elevated TVS's	0	0 <= x <= 25

Figure 8-11. Algorithms - Tornado Detection



### **8.13 VAD**

Three adaptable parameters under the URC LOCA allow local modification of the VAD algorithm. See [Figure 8-12](#). The beginning azimuth angle (TBZ) and ending azimuth angle (TEZ) parameters enable the local site to define a partial circle from which to collect data. This allows the site to restrict data collection over areas where residual clutter may severely bias the velocity estimate (e.g., a ridge line, area of tall buildings, etc.). The third parameter, VAD Analysis Slant Range (VAD), defines the optimal slant range to collect velocity samples. This parameter should be modified to ensure adequate velocity samples are available for analysis. For example, on a cold, clear, dry day, decrease the VAD (slant) range to enable the radar to collect enough samples to perform the VAD analysis. On the other hand, on a muggy summer day, increase the VAD (slant) range to negate the effects of residual ground clutter near the radar.

Close

Save

Undo

Baseline:

Restore

Update

Adaptation Item

VAD

Algorithms

Value

Range

VAD Analysis Slant Range [VAD]	30.0	1.0 <= x <= 230.0, km
Beginning Azimuth Angle [TBZ]	0.0	0.0 <= x <= 359.9, degrees
Ending Azimuth Angle [TEZ]	0.0	0.0 <= x <= 359.9, degrees

Figure 8-12. Algorithms - VAD

## **8.14 Velocity Dealiasing - Multi-PRF**

The Multi-PRF Dealiasing Algorithm (MPDA) technique combines velocity data from multiple sweeps at the same elevation angle (Figure 8-13). This accomplishes two things. First, because each sweep has a different PRF with a corresponding different unambiguous range, Doppler data that may be range folded at one PRF may not be range folded at another PRF. A range folding reduction of 50% to 70% is expected. Second, where there are redundant velocity measurements, MPDA produces robustly dealiased velocity data. Overall accuracy is comparable to velocity dealiasing using a high PRF number. Spectrum width data are range unfolded at the same time as the velocity data.

### **8.14.1 MPDA Data Input/Output**

Raw surveillance mode reflectivity data as they are acquired from the input buffer are immediately sent to the output buffer as RPG base data. A copy of the data are saved for range unfolding the 2nd and 3rd velocity scans later. Doppler velocity data, spectrum width data, and batch mode reflectivity data are not sent to the output buffer and not available for other algorithms to use until all required sweeps have been received and the MPDA has completed processing. Once processing is completed, the RPG base data are sent out in a burst. Above 4.3 degrees elevation, dealiasing reverts to the VDA. Raw base data are received, velocity data dealiased, and all moments sent to the output buffer as RPG base data on a radial basis.

### **8.14.2 MPDA Processing Steps**

After azimuthally aligning data from the multiple velocity sweeps, the MPDA attempts to dealias velocities in all locations with three velocity estimates. The three original velocities or velocities adjusted by the Nyquist co-interval must not differ by more than a threshold value. The MPDA next attempts to dealias locations with only two velocity estimates or locations with three velocity estimates that could not be previously dealiased. Next it attempts to find a solution using individual velocity estimates. Finally, it fills in remaining locations with an un-dealiased velocity estimate that most closely matches its neighbors. At all processing steps, a candidate velocity solution must be within threshold difference of a "seed" velocity. The seed values may come from a previously accepted solution, nearby averages, or the Environmental Wind Table. After each key processing step, data quality modules correct for outliers, large velocity differences along a radial and runs of large azimuthal velocity differences.

### **8.14.3 MPDA NOTES**

Auto PRF - Toggling the Auto PRF function on while MPDA is running is allowed. However, the Auto PRF function will not download VCP 121 to the RDA with a new PRF. The MPDA requires its own predefined PRFs to run correctly.

GUI PRF Selection Tool - The GUI PRF Selection Tool remains functional while in VCP 121 to help the user to decide if running in VCP 121 (MPDA) or using sectorized PRFs is more advantageous.

Algorithm Performance - Because of the time required to acquire two extra velocity scans (about 25 seconds at the lower elevation angles), it is postulated that algorithms that build three-dimensional features by vertically associating two-dimensional features may not work as expected. Tornadic signatures close to the radar may be lost due to weakened velocity gradients and feature translation. Fast-moving weather events would increase the likelihood of a failure. These problems have not been observed in the limited data sets on which the MPDA was developed and tested.

### **8.14.4 Range Unfold Power Difference**

This parameter has the same function as TOVER at the RDA. It is the minimum power difference in dB between echoes at different trips required to determine at which trip to place radar echo returns. The MPDA uses this parameter when range unfolding the second and third velocity scans. Its default value is +5 dB which is the same value that TOVER has. The source scientist for the MPDA originally set this value at +10 dB but during validation testing Applications Branch staff determined lowering the value to +5 dB did not add noise or errors to the MPDA output velocity and did increase the volume of range-unfolded velocities. Set the value higher if there appears to be noise around the echo perimeters. Setting the value below TOVER is not recommended. The parameter may be set anywhere between 0 and +20 dB.

### **8.14.5 Fix Trip Minimum Bin/Fix Trip Maximum Bin**

These two parameters jointly define an annulus around the end of the first trip for each MPDA velocity scan where data are arbitrarily removed. The default values are -7 for the Fix Trip Minimum Bin and -3 for Fix Trip Maximum Bin which assures that no data are removed. Historically, some WSR-88Ds contained rings of noisy velocity data at the end of the first trip, especially with batch cuts. If rings of bad velocity data are observed around the end of first trip mark, the user may set the Fix Trip Minimum as low as -16 and the Fix Trip Maximum Bin +16. During validation testing, no such rings were observed.



Figure 8-13. Algorithms - Velocity Dealiasing - Multi-PRF

## Chapter 9

# Product Distribution Comms Status & RDA/RPG Interface

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### 9.1 Narrowband Communications

Narrowband communications control is exercised through the parameter settings defined in this chapter. Every site has different narrowband communications requirements; therefore, many of the specific parameter settings contained in this chapter will NOT be the same as the settings at any particular site.

Each site is required to maintain a Communications Documentation Notebook to provide a ready reference to facilitate communications problem identification and resolution. The information required for this notebook is provided by the WSR-88D Hotline and should be closely monitored by the local focal point.

#### NOTE

This chapter is provided for reference only.  
Do not modify your narrowband communications parameters to reflect the entries presented here..

### 9.2 Product Distribution Comms Status

Upon initial setup and whenever communications ports are expanded, the narrowband configuration will require modification using this window. Additionally, communications security requirements may necessitate password changes for dial-in ports. The ROC will authorize site personnel to modify the narrowband configuration when these modifications are required. This window also identifies associated users with a dedicated line number and allows password and product availability control for individual dial-in ports. This window also defines timeout and retry time for the narrowband communications interfaces. See Figure 9-1 and Figure 9-2. This window is password protected at the ROC and Agency LOCA.

Product Distribution Comms Status

Close Save Undo Baseline: Restore Update

Line Management

Line # 1 [x25] Comm Mgr # 1

Type Dial-in / PServer # 1

Port Pswd LINE Time Limit 60

Baud Rate 14400 Comms Option No

Line/User Info

User ID / Class /

User Name / Method N/A

Dial-in Users

Prev [Users 1 to 20 of 889] Next

User ID/Name	Pswd	Ovr	T Limit	Class	Method
1 [HOTLINE]	HOTLINE		60	2	N/A
2 [ADS2]	PASSWD		60	2	N/A
3 [ADS3]	PASSWD		60	2	N/A
4 [ADS4]	PASSWD		60	2	N/A
5 [ADS5]	PASSWD		60	2	N/A
6 [ADS6]	PASSWD		60	2	N/A
7 [ADS7]	PASSWD		60	2	N/A
8 [ADS8]	PASSWD		60	2	N/A
9 [ADS9]	PASSWD		60	2	N/A
10 [ADS10]	PASSWD		60	2	N/A
11 [ADS11]	PASSWD		60	2	N/A

Add Dial-in User Delete Dial-in User

Line	Type	Enabled	Proto	ID	User Name	Class	Status	Delay	Rate
1	DIALIN	Yes	X25			2	CON PEND	0%	-
2	DIALIN	Yes	X25			2	CON PEND	0%	-
3	DIALIN	Yes	X25			2	CON PEND	0%	-
4	DIALIN	Yes	X25			2	CON PEND	0%	-
5	DIALIN	Yes	X25			2	CON PEND	0%	-
6	DIALIN	Yes	X25			2	CON PEND	0%	-
7	DIALIN	Yes	X25			2	CON PEND	0%	-
8	DIALIN	Yes	X25			2	CON PEND	0%	-
9	DEDIC	Yes	X25			RPGOP_50	CON PEND	0%	-
10	DEDIC	Yes	X25			1	CON PEND	0%	-
11	DEDIC	Yes	X25			1	CON PEND	0%	-
12	DEDIC	Yes	X25			1	CON PEND	0%	-
13	DEDIC	Yes	X25			1	CON PEND	0%	-
14	DEDIC	Yes	X25			1	CON PEND	0%	-
15	DEDIC	Yes	X25			1	CON PEND	0%	-
16	DEDIC	Yes	X25			1	CON PEND	0%	-
17	DEDIC	Yes	X25			1	CON PEND	0%	-
18	DEDIC	Yes	X25			1	CON PEND	0%	-
19	DEDIC	Yes	X25			1	CON PEND	0%	-
20	DEDIC	Yes	X25			1	CON PEND	0%	-
21	DEDIC	Yes	X25			1	CON PEND	0%	-
22	DEDIC	Yes	X25			1	CON PEND	0%	-
23	DEDIC	Yes	X25			1	CON PEND	0%	-
24	DEDIC	Yes	X25			1	CON PEND	0%	-

Prev --- Next Sorted By: Line Type Status

Line Control

Reset Disconnect Connect Deselect

General Parameters

Retries 2 Timeout 120 Alarm (%) 100 Warning (%) 95

Figure 9-1. Product Distribution Comms Status (Lines 1-24)

Product Distribution Comms Status

Close Save Undo Baseline: Restore Update

Line Management

Line # [25 [TCP] Comm Mgr # [4]

Type [Dedicated] PServer # [4]

Port Pswd [ ] Time Limit [N/A]

Baud Rate [1000000] Comms Option [No]

Line/User Info

User ID [ ] Class [RPGOP\_1]

User Name [ ] Method [N/A]

Dial-in Users

Prev [Users 1 to 20 of 891] Next

User ID/Name	Pswd	Ovr	T	Limit	Class	Method
1 [HOTLINE]	[HOTLINE]	[60]	[ ]	[2]	[N/A]	[ ]
2 [ADS2]	[PASSND]	[60]	[ ]	[2]	[N/A]	[ ]
3 [ADS3]	[PASSND]	[60]	[ ]	[2]	[N/A]	[ ]
4 [ADS4]	[PASSND]	[60]	[ ]	[2]	[N/A]	[ ]
5 [ADS5]	[PASSND]	[60]	[ ]	[2]	[N/A]	[ ]
6 [ADS6]	[PASSND]	[60]	[ ]	[2]	[N/A]	[ ]
7 [ADS7]	[PASSND]	[60]	[ ]	[2]	[N/A]	[ ]
8 [ADS8]	[PASSND]	[60]	[ ]	[2]	[N/A]	[ ]
9 [ADS9]	[PASSND]	[60]	[ ]	[2]	[N/A]	[ ]
10 [ADS10]	[PASSND]	[60]	[ ]	[2]	[N/A]	[ ]
11 [ADS11]	[PASSND]	[60]	[ ]	[2]	[N/A]	[ ]

Add Dial-in User Delete Dial-in User

Line	Type	Enabled	Proto	ID	User Name	Class	Status	Delay	Rate
25	DEDIC	yes	TCP		RPGOP_90		CON PEND	0%	-
26	WAN	yes	TCP				CON PEND	0%	-
27	WAN	yes	TCP				CON PEND	0%	-
28	WAN	yes	TCP				CON PEND	0%	-
29	WAN	yes	TCP				CON PEND	0%	-
30	WAN	yes	TCP				CON PEND	0%	-
31	WAN	yes	TCP				CON PEND	0%	-
32	WAN	yes	TCP				CON PEND	0%	-
33	DEDIC	yes	TCP		RPGOP_50		CON PEND	0%	-
34	DEDIC	yes	TCP		RPGOP_50		CON PEND	0%	-
35	DEDIC	yes	TCP		RPGOP_50		CON PEND	0%	-
36	DEDIC	yes	TCP		RPGOP_50		CON PEND	0%	-
37	DEDIC	yes	TCP		RPGOP_50		CON PEND	0%	-
38	DIALIN	yes	TCP				CON PEND	0%	-
39	DIALIN	yes	TCP				CON PEND	0%	-
40	DIALIN	yes	TCP				CON PEND	0%	-
41	WAN	yes	TCP				CON PEND	0%	-
42	WAN	yes	TCP				CON PEND	0%	-

Prev [ ] Next Sorted By: ☐ Line ☐ Type ☐ Status

Line Control

Reset Disconnect Connect Deselect

General Parameters

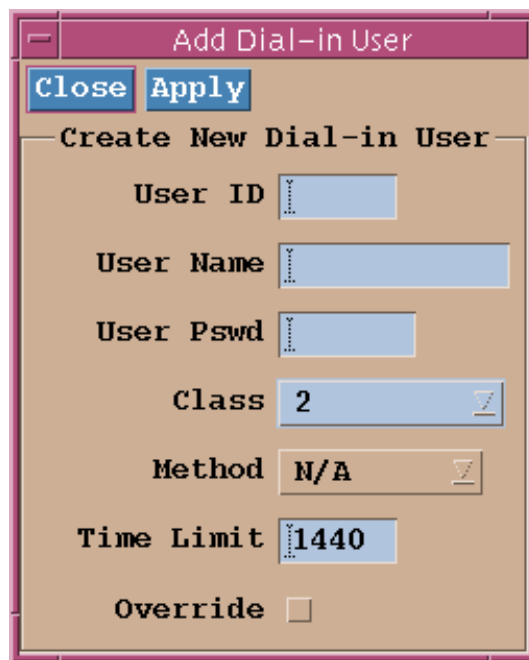
Retries [2] Timeout [120] Alarm (%) [100] Warning (%) [95]

Figure 9-2. Product Distribution Comms Status (Lines 25-42)



### 9.2.1 Dial-In Users

In the lower right hand corner of the Product Distribution Comms Status window is the Dial-in Users section. This section is used to specify those dial-in users authorized access to the RPG and to assign site-specific dial-in user passwords, override, time limit, and class. Changes to this section, including instructions to make the modifications, are provided by the WSR-88D Hotline. Dial-in users can be added in this section by clicking on the Add Dial-In User window button (Figure 9-3). This window is only available through the ROC and Agency LOCA authority. There is also a Delete Dial-In User window button, but this function is currently disabled.



The screenshot shows a window titled "Add Dial-In User". At the top, there are two buttons: "Close" and "Apply". Below these is a section header "Create New Dial-in User". Under this header, there are several input fields: "User ID" (empty), "User Name" (empty), "User Pswd" (empty), "Class" (set to "2"), "Method" (set to "N/A"), "Time Limit" (set to "1440"), and an "Override" checkbox which is unchecked.

Figure 9-3. Add Dial-In User

### 9.3 RDA/RPG Interface Control/Status

This window is accessed by clicking on the wideband connection on the RPG Control/Status window. It defines the timeout and retry times for the wideband as well as connect and disconnect control and status. See Figure 9-4.

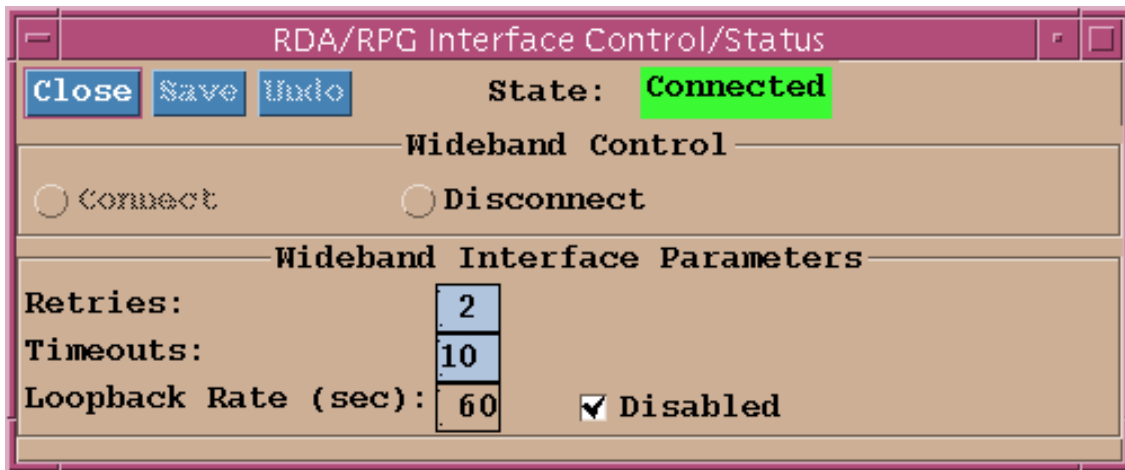


Figure 9-4. RDA/RPG Interface Control/Status

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## Chapter 10

# USERS Products - RPG Product Distribution Control

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### 10.1 Class 2 Users

Open the RPG Product Distribution Control window by clicking on the Products button in the USERS box. The default window is the RPG Product Distribution Control-Class 2 Users. See Figures 10-1 through 10-5.

The only locked area on the screen is the Baseline: Update button, which is password protected at the ROC LOCA. Each site can edit any of the distribution fields at any time for either the Precipitation Mode (A) or Clear Air Mode (B) as the check boxes are sensitized with a light blue background.

RPG Product Distribution Control

Close Save Undo Baseline: Restore Update

User Class

☐ Class 2 Users [Permission] ☐ Class 4 Users [Distribution]

Set All Products

☐ Precipitation Mode (A) ☐ Clear Air Mode (B)

Filter Product List

Search: Sort by: ☐ Product Code ☐ Product MNE ☐ Description

MNE	Code	A	B	Freq Elev/Cut(s)	Product Description
R	16	<input type="checkbox"/>	<input type="checkbox"/>	N/A	Base Reflectivity: 8 level/0.54 mm
R	17	<input type="checkbox"/>	<input type="checkbox"/>	N/A	Base Reflectivity: 8 level/1.1 mm
R	18	<input type="checkbox"/>	<input checked="" type="checkbox"/>	N/A	Base Reflectivity: 8 level/2.2 mm
R	19	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	N/A	Base Reflectivity: 16 level/0.54 mm
R	20	<input checked="" type="checkbox"/>	<input type="checkbox"/>	N/A	Base Reflectivity: 16 level/1.1 mm
R	21	<input type="checkbox"/>	<input type="checkbox"/>	N/A	Base Reflectivity: 16 level/2.2 mm
V	22	<input type="checkbox"/>	<input type="checkbox"/>	N/A	Base Velocity: 8 level/0.13 mm
V	23	<input type="checkbox"/>	<input type="checkbox"/>	N/A	Base Velocity: 8 level/0.27 mm
V	24	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	N/A	Base Velocity: 8 level/0.54 mm
V	25	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	N/A	Base Velocity: 16 level/0.13 mm
V	26	<input type="checkbox"/>	<input checked="" type="checkbox"/>	N/A	Base Velocity: 16 level/0.27 mm
V	27	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	N/A	Base Velocity: 16 level/0.54 mm
SW	28	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	N/A	Base Spectrum Width: 8 level/0.13 mm
SW	29	<input type="checkbox"/>	<input checked="" type="checkbox"/>	N/A	Base Spectrum Width: 8 level/0.27 mm
SW	30	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	N/A	Base Spectrum Width: 8 level/0.54 mm
USP	31	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	N/A	User Selectable Storm Total Precipitation: 16 level/1.1 mm
DHR	32	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	N/A	Digital Hybrid Scan Reflectivity: 256 level/0.54 mm
HSR	33	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	N/A	Scan Reflectivity: 16 level/0.54 mm
CFC	34	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	N/A	Clutter Filter Control: 8 level/0.54 mm

Figure 10-1. RPG Product Distribution Control - Class 2 Users (Products 16-34)

RPG Product Distribution Control

Close Save Undo Baseline: Restore Update

User Class

☐ Class 2 Users [Permission] ☐ Class 4 Users [Distribution]

Set All Products

☐ Precipitation Mode (A) ☐ Clear Air Mode (B)

Filter Product List

Search: Sort by: ☐ Product Code ☐ Product MNE ☐ Description

MNE	Code	A	B	Freq	Elev/Cut(s)	Product Description
CR	35	<input type="checkbox"/>	<input type="checkbox"/>	N/A	<input type="checkbox"/> <=	N/A Composite Reflectivity: 8 level/0.54 mm
CR	36	<input type="checkbox"/>	<input checked="" type="checkbox"/>	N/A	<input type="checkbox"/> <=	N/A Composite Reflectivity: 8 level/2.2 mm
CR	37	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	N/A	<input type="checkbox"/> <=	N/A Composite Reflectivity: 16 level/0.54 mm
CR	38	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	N/A	<input type="checkbox"/> <=	N/A Composite Reflectivity: 16 level/2.2 mm
ET	41	<input checked="" type="checkbox"/>	<input type="checkbox"/>	N/A	<input type="checkbox"/> <=	N/A Echo Tops: 16 level/2.2 mm
SWR	43	<input type="checkbox"/>	<input type="checkbox"/>	N/A	<input type="checkbox"/> <=	N/A Severe Weather (Reflectivity): 16 level/0.54 mm
SWV	44	<input type="checkbox"/>	<input type="checkbox"/>	N/A	<input type="checkbox"/> <=	N/A Severe Weather (Velocity): 16 level/0.13 mm
SWW	45	<input type="checkbox"/>	<input type="checkbox"/>	N/A	<input type="checkbox"/> <=	N/A Severe Weather (Spectrum Width): 16 level/0.13 mm
SWS	46	<input type="checkbox"/>	<input type="checkbox"/>	N/A	<input type="checkbox"/> <=	N/A Severe Weather (Shear): 16 level/0.27 mm
SWP	47	<input checked="" type="checkbox"/>	<input type="checkbox"/>	N/A	<input type="checkbox"/> <=	N/A Severe Weather Probability: 4 level/2.2 mm
VWP	48	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	N/A	<input type="checkbox"/> <=	N/A VAD Wind Profile
RCS	50	<input type="checkbox"/>	<input type="checkbox"/>	N/A	<input type="checkbox"/> <=	N/A Cross Section (Reflectivity): 16 level/0.54 x 0.27 mm
VCS	51	<input type="checkbox"/>	<input type="checkbox"/>	N/A	<input type="checkbox"/> <=	N/A Cross Section (Velocity): 16 level/0.54 x 0.27 mm
SRR	55	<input type="checkbox"/>	<input type="checkbox"/>	N/A	<input type="checkbox"/> <=	N/A Storm Relative Velocity (Region): 16 level/0.27 mm
SRM	56	<input checked="" type="checkbox"/>	<input type="checkbox"/>	N/A	<input type="checkbox"/> <=	N/A Storm Relative Velocity (Map): 16 level/0.54 mm
VIL	57	<input checked="" type="checkbox"/>	<input type="checkbox"/>	N/A	<input type="checkbox"/> <=	N/A Vertically Integrated Liquid: 16 level/2.2 mm
STI	58	<input checked="" type="checkbox"/>	<input type="checkbox"/>	N/A	<input type="checkbox"/> <=	N/A Storm Tracking Information
HI	59	<input checked="" type="checkbox"/>	<input type="checkbox"/>	N/A	<input type="checkbox"/> <=	N/A Hail Index
M	60	<input checked="" type="checkbox"/>	<input type="checkbox"/>	N/A	<input type="checkbox"/> <=	N/A Mesocyclone

Figure 10-2. RPG Product Distribution Control - Class 2 Users (Products 35-60)

RPG Product Distribution Control

Close Save Undo Baseline: Restore Update

User Class

☒ Class 2 Users [Permission] ☐ Class 4 Users [Distribution]

Set All Products

☐ Precipitation Mode (A) ☐ Clear Air Mode (B)

Filter Product List

Search: Sort by: ☒ Product Code ☐ Product MNE ☐ Description

MNE	Code	A	B	Freq	Elev	Cut(s)	Product Description
TVS	61	<input checked="" type="checkbox"/>	<input type="checkbox"/>	N/A	<input type="checkbox"/>	N/A	Tornado Vortex Signature
SS	62	<input checked="" type="checkbox"/>	<input type="checkbox"/>	N/A	<input type="checkbox"/>	N/A	Storm Structure
LRA	63	<input type="checkbox"/>	<input type="checkbox"/>	N/A	<input type="checkbox"/>	N/A	Layer Composite Reflectivity (Layer 1 Average)
LRA	64	<input type="checkbox"/>	<input type="checkbox"/>	N/A	<input type="checkbox"/>	N/A	Layer Composite Reflectivity (Layer 2 Average)
LRM	65	<input checked="" type="checkbox"/>	<input type="checkbox"/>	N/A	<input type="checkbox"/>	N/A	Layer Composite Reflectivity (Layer 1 Maximum)
LRM	66	<input checked="" type="checkbox"/>	<input type="checkbox"/>	N/A	<input type="checkbox"/>	N/A	Layer Composite Reflectivity (Layer 2 Maximum)
APR	67	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	N/A	<input type="checkbox"/>	N/A	Layer Composite Reflectivity - AP Removed: 8 level/2.2 mm
UAM	73	<input type="checkbox"/>	<input type="checkbox"/>	N/A	<input type="checkbox"/>	N/A	User Alert Message
RCM	74	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	N/A	<input type="checkbox"/>	N/A	Radar Coded Message
FTM	75	<input type="checkbox"/>	<input type="checkbox"/>	N/A	<input type="checkbox"/>	N/A	Free Text Message
OHP	78	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	N/A	<input type="checkbox"/>	N/A	Surface Rainfall Accumulation (1 hr): 16 level/1.1 mm
THP	79	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	N/A	<input type="checkbox"/>	N/A	Surface Rainfall Accumulation (3 hr): 16 level/1.1 mm
STP	80	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	N/A	<input type="checkbox"/>	N/A	Storm Total Rainfall Accumulation: 16 level/1.1 mm
DPA	81	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	N/A	<input type="checkbox"/>	N/A	Hourly Digital Precip Array: 256 level
SPD	82	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	N/A	<input type="checkbox"/>	N/A	Supplemental Precipitation Data
VAD	84	<input type="checkbox"/>	<input type="checkbox"/>	N/A	<input type="checkbox"/>	N/A	Velocity Azimuth Display: 8 level/5 kts
RCS	85	<input type="checkbox"/>	<input type="checkbox"/>	N/A	<input type="checkbox"/>	N/A	Cross Section (Reflectivity): 8 level/0.54 x 0.27 mm
VCS	86	<input type="checkbox"/>	<input type="checkbox"/>	N/A	<input type="checkbox"/>	N/A	Cross Section (Velocity): 8 level/0.54 x 0.27 mm
CS	87	<input type="checkbox"/>	<input type="checkbox"/>	N/A	<input type="checkbox"/>	N/A	Combined Shear: 16 level

Figure 10-3. RPG Product Distribution Control - Class 2 Users (Products 61-87)

RPG Product Distribution Control

Close Save Undo Baseline: Restore Update

User Class

☒ Class 2 Users [Permission] ☐ Class 4 Users [Distribution]

Set All Products

☐ Precipitation Mode (A) ☐ Clear Air Mode (B)

Filter Product List

Search:  Sort by: ☒ Product Code ☐ Product MNE ☐ Description

MNE	Code	A	B	Freq	Elev	Cut(s)	Product Description
LRA	89	<input type="checkbox"/>	<input type="checkbox"/>	N/A	<input type="checkbox"/>	N/A	Layer Composite Reflectivity (Layer 3 Average): 8 level/2.2 mm
LRM	90	<input checked="" type="checkbox"/>	<input type="checkbox"/>	N/A	<input type="checkbox"/>	N/A	Layer Composite Reflectivity (Layer 3 Maximum): 8 level/2.2 mm
DBV	93	<input type="checkbox"/>	<input type="checkbox"/>	N/A	<input type="checkbox"/>	N/A	ITWS Digital Velocity Product: 256 level/0.54 mm
DR	94	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	N/A	<input type="checkbox"/>	N/A	Base Reflectivity Data Array Product: 256 level/0.54 mm
CRE	95	<input type="checkbox"/>	<input type="checkbox"/>	N/A	<input type="checkbox"/>	N/A	Composite Reflectivity Edited for AP: 8 level/0.54 mm
CRE	96	<input type="checkbox"/>	<input type="checkbox"/>	N/A	<input type="checkbox"/>	N/A	Composite Reflectivity Edited for AP: 8 level/2.2 mm
CRE	97	<input type="checkbox"/>	<input type="checkbox"/>	N/A	<input type="checkbox"/>	N/A	Composite Reflectivity Edited for AP: 16 level/0.54 mm
CRE	98	<input type="checkbox"/>	<input type="checkbox"/>	N/A	<input type="checkbox"/>	N/A	Composite Reflectivity Edited for AP: 16 level/2.2 mm
DV	99	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	N/A	<input type="checkbox"/>	N/A	Base Velocity Data Array Product: 256 level/0.13 mm
CLR	132	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	N/A	<input type="checkbox"/>	N/A	Clutter Likelihood Reflectivity: 11 level/0.54 mm
CLD	133	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	N/A	<input type="checkbox"/>	N/A	Clutter Likelihood Doppler: 12 level/0.54 mm
DVL	134	<input type="checkbox"/>	<input type="checkbox"/>	N/A	<input type="checkbox"/>	N/A	High Resolution Digital VIL: 256 level/0.54 mm
EET	135	<input type="checkbox"/>	<input type="checkbox"/>	N/A	<input type="checkbox"/>	N/A	Enhanced Echo Tops: 71 level/0.54 mm
SO	136	<input type="checkbox"/>	<input type="checkbox"/>	N/A	<input type="checkbox"/>	N/A	Superob: NCEP Winds Model Initialization
ULR	137	<input type="checkbox"/>	<input type="checkbox"/>	N/A	<input type="checkbox"/>	N/A	User Selectable Layer Composite Reflectivity (Maximum)
DSP	138	<input type="checkbox"/>	<input type="checkbox"/>	N/A	<input type="checkbox"/>	N/A	Digital Storm Total Rainfall Accumulation: 256 level/1.1 mm
MRU	139	<input checked="" type="checkbox"/>	<input type="checkbox"/>	N/A	<input type="checkbox"/>	N/A	Mesocyclone Rapid Update
MD	141	<input checked="" type="checkbox"/>	<input type="checkbox"/>	N/A	<input type="checkbox"/>	N/A	Mesocyclone Detection Product
TRU	143	<input checked="" type="checkbox"/>	<input type="checkbox"/>	N/A	<input type="checkbox"/>	N/A	Tornado Detection Rapid Update Product

Figure 10-4. RPG Product Distribution Control - Class 2 Users (Products 89-143)

RPG Product Distribution Control

Close Save Undo Baseline: Restore Update

User Class

☒ Class 2 Users [Permission] ☐ Class 4 Users [Distribution]

Set All Products

☐ Precipitation Mode (A) ☐ Clear Air Mode (B)

Filter Product List

Search: Sort by: ☒ Product Code ☐ Product MNE ☐ Description

MNE	Code	A	B	Freq	Elev	Cut(s)	Product Description
CLR	132	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	N/A	<input type="checkbox"/>	<=	N/A Clutter Likelihood Reflectivity: 11 level/0.54 mm
CLD	133	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	N/A	<input type="checkbox"/>	<=	N/A Clutter Likelihood Doppler: 12 level/0.54 mm
DVL	134	<input type="checkbox"/>	<input type="checkbox"/>	N/A	<input type="checkbox"/>	<=	N/A High Resolution Digital VIL: 256 level/0.54 mm
EET	135	<input type="checkbox"/>	<input type="checkbox"/>	N/A	<input type="checkbox"/>	<=	N/A Enhanced Echo Tops: 71 level/0.54 mm
SO	136	<input type="checkbox"/>	<input type="checkbox"/>	N/A	<input type="checkbox"/>	<=	N/A Superob: NCEP Winds Model Initialization
ULR	137	<input type="checkbox"/>	<input type="checkbox"/>	N/A	<input type="checkbox"/>	<=	N/A User Selectable Layer Composite Reflectivity (Maximum)
DSP	138	<input type="checkbox"/>	<input type="checkbox"/>	N/A	<input type="checkbox"/>	<=	N/A Digital Storm Total Rainfall Accumulation: 256 level/1.1 mm
MRU	139	<input checked="" type="checkbox"/>	<input type="checkbox"/>	N/A	<input type="checkbox"/>	<=	N/A Mesocyclone Rapid Update
MD	141	<input checked="" type="checkbox"/>	<input type="checkbox"/>	N/A	<input type="checkbox"/>	<=	N/A Mesocyclone Detection Product
TRU	143	<input checked="" type="checkbox"/>	<input type="checkbox"/>	N/A	<input type="checkbox"/>	<=	N/A Tornado Detection Rapid Update Product
OSW	144	<input type="checkbox"/>	<input type="checkbox"/>	N/A	<input type="checkbox"/>	<=	N/A One-hour Snow Accumulation (Water Equiv.): 16 level/0.54 mm
OSD	145	<input type="checkbox"/>	<input type="checkbox"/>	N/A	<input type="checkbox"/>	<=	N/A One-hour Snow Accumulation (Depth): 16 level/0.54 mm
SSW	146	<input type="checkbox"/>	<input type="checkbox"/>	N/A	<input type="checkbox"/>	<=	N/A Storm Total Snow Accumulation (Water Equiv.): 16 level/0.54 mm
SSD	147	<input type="checkbox"/>	<input type="checkbox"/>	N/A	<input type="checkbox"/>	<=	N/A Storm Total Snow Accumulation (Depth): 16 level/0.54 mm
DMD	149	<input checked="" type="checkbox"/>	<input type="checkbox"/>	N/A	<input type="checkbox"/>	<=	N/A Mesocyclone Detection Data Array Product
USW	150	<input type="checkbox"/>	<input type="checkbox"/>	N/A	<input type="checkbox"/>	<=	N/A User Selectable Snow Accumulation (Water Equiv.): 16 level/0.54
USD	151	<input type="checkbox"/>	<input type="checkbox"/>	N/A	<input type="checkbox"/>	<=	N/A User Selectable Snow Accumulation (Depth): 16 level/0.54 mm

Figure 10-5. RPG Product Distribution Control - Class 2 Users (Products 132-151)



## 10.2 Class 4 Users

The user can switch to the Class 4 Users listing and modify the distribution options in a similar fashion. See Figures 10-6 through 10-10. The only locked area on the screen is the Baseline: Update button, which is password protected at the ROC LOCA. Each site can edit any of the distribution fields at any time for either the Precipitation Mode (A) or Clear Air Mode (B) as the check boxes are sensitized with a light blue background.

MNE	Code	A	B	Freq	Elev/Cut(s)	Product Description
R	16	<input type="checkbox"/>	<input type="checkbox"/>	0	<input type="checkbox"/> <=	0.0 Base Reflectivity: 8 level/0.54 nm
R	17	<input type="checkbox"/>	<input type="checkbox"/>	0	<input type="checkbox"/> <=	0.0 Base Reflectivity: 8 level/1.1 nm
R	18	<input type="checkbox"/>	<input type="checkbox"/>	0	<input type="checkbox"/> <=	0.0 Base Reflectivity: 8 level/2.2 nm
R	19	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	1	<input type="checkbox"/> <=	1.1 Base Reflectivity: 16 level/0.54 nm
R	20	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	1	<input type="checkbox"/> <=	1.1 Base Reflectivity: 16 level/1.1 nm
R	21	<input type="checkbox"/>	<input type="checkbox"/>	0	<input type="checkbox"/> <=	0.0 Base Reflectivity: 16 level/2.2 nm
V	22	<input type="checkbox"/>	<input type="checkbox"/>	0	<input type="checkbox"/> <=	0.0 Base Velocity: 8 level/0.13 nm
V	23	<input type="checkbox"/>	<input type="checkbox"/>	0	<input type="checkbox"/> <=	0.0 Base Velocity: 8 level/0.27 nm
V	24	<input type="checkbox"/>	<input type="checkbox"/>	0	<input type="checkbox"/> <=	0.0 Base Velocity: 8 level/0.54 nm
V	25	<input type="checkbox"/>	<input type="checkbox"/>	0	<input type="checkbox"/> <=	0.0 Base Velocity: 16 level/0.13 nm
V	26	<input type="checkbox"/>	<input type="checkbox"/>	0	<input type="checkbox"/> <=	0.0 Base Velocity: 16 level/0.27 nm
V	27	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	1	<input type="checkbox"/> <=	1.1 Base Velocity: 16 level/0.54 nm
SW	28	<input type="checkbox"/>	<input type="checkbox"/>	0	<input type="checkbox"/> <=	0.0 Base Spectrum Width: 8 level/0.13 nm
SW	29	<input type="checkbox"/>	<input type="checkbox"/>	0	<input type="checkbox"/> <=	0.0 Base Spectrum Width: 8 level/0.27 nm
SW	30	<input type="checkbox"/>	<input type="checkbox"/>	0	<input type="checkbox"/> <=	0.0 Base Spectrum Width: 8 level/0.54 nm
USP	31	<input type="checkbox"/>	<input type="checkbox"/>	0	<input type="checkbox"/> <=	N/A User Selectable Storm Total Precipitation: 16 level/1.1 nm
DHR	32	<input type="checkbox"/>	<input type="checkbox"/>	0	<input type="checkbox"/> <=	N/A Digital Hybrid Scan Reflectivity: 256 level/0.54 nm
HSR	33	<input type="checkbox"/>	<input type="checkbox"/>	0	<input type="checkbox"/> <=	N/A Scan Reflectivity: 16 level/0.54 nm
CFC	34	<input type="checkbox"/>	<input type="checkbox"/>	0	<input type="checkbox"/> <=	N/A Clutter Filter Control: 8 level/0.54 nm

This product has no extra parameters

Figure 10-6. RPG Product Distribution Control - Class 4 Users (Products 16-34)

## Class 4 Users

RPG Product Distribution Control

Close Save Undo Baseline: Restore Update

User Class

☐ Class 2 Users [Permission] ☒ Class 4 Users [Distribution]

Filter Product List

Search: Sort by: ☐ Product Code ☐ Product MNE ☐ Description

MNE	Code	A	B	Freq	Elev/Cut(s)	Product	Description
CR	35	<input type="checkbox"/>	<input type="checkbox"/>	0	<input type="checkbox"/> <=	N/A	Composite Reflectivity: 8 level/0.54 nm
CR	36	<input type="checkbox"/>	<input checked="" type="checkbox"/>	1	<input type="checkbox"/> <=	N/A	Composite Reflectivity: 8 level/2.2 nm
CR	37	<input type="checkbox"/>	<input type="checkbox"/>	0	<input type="checkbox"/> <=	N/A	Composite Reflectivity: 16 level/0.54 nm
CR	38	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	1	<input type="checkbox"/> <=	N/A	Composite Reflectivity: 16 level/2.2 nm
ET	41	<input checked="" type="checkbox"/>	<input type="checkbox"/>	1	<input type="checkbox"/> <=	N/A	Echo Tops: 16 level/2.2 nm
SWR	43	<input type="checkbox"/>	<input type="checkbox"/>	0	<input type="checkbox"/> <=	0.0	Severe Weather (Reflectivity): 16 level/0.54 nm
SWV	44	<input type="checkbox"/>	<input type="checkbox"/>	0	<input type="checkbox"/> <=	0.0	Severe Weather (Velocity): 16 level/0.13 nm
SWW	45	<input type="checkbox"/>	<input type="checkbox"/>	0	<input type="checkbox"/> <=	0.0	Severe Weather (Spectrum Width): 16 level/0.13 nm
SWS	46	<input type="checkbox"/>	<input type="checkbox"/>	0	<input type="checkbox"/> <=	0.0	Severe Weather (Shear): 16 level/0.27 nm
SWP	47	<input type="checkbox"/>	<input type="checkbox"/>	0	<input type="checkbox"/> <=	N/A	Severe Weather Probability: 4 level/2.2 nm
VWP	48	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	1	<input type="checkbox"/> <=	N/A	VAD Wind Profile
RCS	50	<input type="checkbox"/>	<input type="checkbox"/>	0	<input type="checkbox"/> <=	N/A	Cross Section (Reflectivity): 16 level/0.54 x 0.27 nm
VCS	51	<input type="checkbox"/>	<input type="checkbox"/>	0	<input type="checkbox"/> <=	N/A	Cross Section (Velocity): 16 level/0.54 x 0.27 nm
SRR	55	<input type="checkbox"/>	<input type="checkbox"/>	0	<input type="checkbox"/> <=	0.0	Storm Relative Velocity (Region): 16 level/0.27 nm
SRM	56	<input checked="" type="checkbox"/>	<input type="checkbox"/>	1	<input type="checkbox"/> <=	1.1	Storm Relative Velocity (Map): 16 level/0.54 nm
VIL	57	<input checked="" type="checkbox"/>	<input type="checkbox"/>	1	<input type="checkbox"/> <=	N/A	Vertically Integrated Liquid: 16 level/2.2 nm
STI	58	<input type="checkbox"/>	<input type="checkbox"/>	0	<input type="checkbox"/> <=	N/A	Storm Tracking Information
HI	59	<input type="checkbox"/>	<input type="checkbox"/>	0	<input type="checkbox"/> <=	N/A	Hail Index
M	60	<input type="checkbox"/>	<input type="checkbox"/>	0	<input type="checkbox"/> <=	N/A	Mesocyclone

This product has no extra parameters

Figure 10-7. RPG Product Distribution Control - Class 4 Users (Products 35-60)

RPG Product Distribution Control

Close Save Undo Baseline: Restore Update

User Class

☐ Class 2 Users [Permission] ☒ Class 4 Users [Distribution]

Filter Product List

Search: Sort by: ☐ Product Code ☐ Product MNE ☐ Description

MNE	Code	A	B	Freq	Elev/Cut(s)	Product	Description
TVS	61	<input type="checkbox"/>	<input type="checkbox"/>	0	<input type="checkbox"/> <=	N/A	Tornado Vortex Signature
SS	62	<input type="checkbox"/>	<input type="checkbox"/>	0	<input type="checkbox"/> <=	N/A	Storm Structure
LRA	63	<input type="checkbox"/>	<input type="checkbox"/>	0	<input type="checkbox"/> <=	N/A	Layer Composite Reflectivity (Layer 1 Average)
LRA	64	<input type="checkbox"/>	<input type="checkbox"/>	0	<input type="checkbox"/> <=	N/A	Layer Composite Reflectivity (Layer 2 Average)
LRM	65	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	1	<input type="checkbox"/> <=	N/A	Layer Composite Reflectivity (Layer 1 Maximum)
LRM	66	<input checked="" type="checkbox"/>	<input type="checkbox"/>	1	<input type="checkbox"/> <=	N/A	Layer Composite Reflectivity (Layer 2 Maximum)
APR	67	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	1	<input type="checkbox"/> <=	N/A	Layer Composite Reflectivity - AP Removed: 8 level/2.2 mm
UAM	73	<input type="checkbox"/>	<input type="checkbox"/>	0	<input type="checkbox"/> <=	N/A	User Alert Message
RCM	74	<input type="checkbox"/>	<input type="checkbox"/>	0	<input type="checkbox"/> <=	N/A	Radar Coded Message
FTM	75	<input type="checkbox"/>	<input type="checkbox"/>	0	<input type="checkbox"/> <=	N/A	Free Text Message
OHP	78	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	1	<input type="checkbox"/> <=	N/A	Surface Rainfall Accumulation (1 hr): 16 level/1.1 mm
THP	79	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	1	<input type="checkbox"/> <=	N/A	Surface Rainfall Accumulation (3 hr): 16 level/1.1 mm
STP	80	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	1	<input type="checkbox"/> <=	N/A	Storm Total Rainfall Accumulation: 16 level/1.1 mm
DPA	81	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	1	<input type="checkbox"/> <=	N/A	Hourly Digital Precip Array: 256 level
SPD	82	<input type="checkbox"/>	<input type="checkbox"/>	0	<input type="checkbox"/> <=	N/A	Supplemental Precipitation Data
VAD	84	<input type="checkbox"/>	<input type="checkbox"/>	0	<input type="checkbox"/> <=	N/A	Velocity Azimuth Display: 8 level/5 kts
RCS	85	<input type="checkbox"/>	<input type="checkbox"/>	0	<input type="checkbox"/> <=	N/A	Cross Section (Reflectivity): 8 level/0.54 x 0.27 mm
VCS	86	<input type="checkbox"/>	<input type="checkbox"/>	0	<input type="checkbox"/> <=	N/A	Cross Section (Velocity): 8 level/0.54 x 0.27 mm
CS	87	<input type="checkbox"/>	<input type="checkbox"/>	0	<input type="checkbox"/> <=	N/A	Combined Shear: 16 level

This product has no extra parameters

Figure 10-8. RPG Product Distribution Control - Class 4 Users (Products 61-87)

RPG Product Distribution Control

Close Save Undo Baseline: Restore Update

User Class

☐ Class 2 Users [Permission] ☒ Class 4 Users [Distribution]

Filter Product List

Search: Sort by: ☐ Product Code ☐ Product MNE ☐ Description

MNE	Code	A	B	Freq	Elev/Cut(s)	Product Description
LRA	89	<input type="checkbox"/>	<input type="checkbox"/>	0	<= N/A	Layer Composite Reflectivity (Layer 3 Average): 8 level/2.2 mm
LRM	90	<input checked="" type="checkbox"/>	<input type="checkbox"/>	1	<= N/A	Layer Composite Reflectivity (Layer 3 Maximum): 8 level/2.2 mm
DBV	93	<input type="checkbox"/>	<input type="checkbox"/>	0	<= 0.0	ITWS Digital Velocity Product: 256 level/0.54 mm
DR	94	<input type="checkbox"/>	<input type="checkbox"/>	0	<= 0.0	Base Reflectivity Data Array Product: 256 level/0.54 mm
CRE	95	<input type="checkbox"/>	<input type="checkbox"/>	0	<= N/A	Composite Reflectivity Edited for AP: 8 level/0.54 mm
CRE	96	<input type="checkbox"/>	<input type="checkbox"/>	0	<= N/A	Composite Reflectivity Edited for AP: 8 level/2.2 mm
CRE	97	<input type="checkbox"/>	<input type="checkbox"/>	0	<= N/A	Composite Reflectivity Edited for AP: 16 level/0.54 mm
CRE	98	<input type="checkbox"/>	<input type="checkbox"/>	0	<= N/A	Composite Reflectivity Edited for AP: 16 level/2.2 mm
DV	99	<input type="checkbox"/>	<input type="checkbox"/>	0	<= 0.0	Base Velocity Data Array Product: 256 level/0.13 mm
CLR	132	<input type="checkbox"/>	<input type="checkbox"/>	0	<= 0.0	Clutter Likelihood Reflectivity: 11 level/0.54 mm
CLD	133	<input type="checkbox"/>	<input type="checkbox"/>	0	<= 0.0	Clutter Likelihood Doppler: 12 level/0.54 mm
DVL	134	<input type="checkbox"/>	<input type="checkbox"/>	0	<= N/A	High Resolution Digital VIL: 256 level/0.54 mm
EET	135	<input type="checkbox"/>	<input type="checkbox"/>	0	<= N/A	Enhanced Echo Tops: 71 level/0.54 mm
SO	136	<input type="checkbox"/>	<input type="checkbox"/>	0	<= N/A	Superob: NCEP Winds Model Initialization
ULR	137	<input type="checkbox"/>	<input type="checkbox"/>	0	<= N/A	User Selectable Layer Composite Reflectivity (Maximum)
DSP	138	<input type="checkbox"/>	<input type="checkbox"/>	0	<= N/A	Digital Storm Total Rainfall Accumulation: 256 level/1.1 mm
MRU	139	<input type="checkbox"/>	<input type="checkbox"/>	0	<= 0.0	Mesocyclone Rapid Update
MD	141	<input type="checkbox"/>	<input type="checkbox"/>	0	<= N/A	Mesocyclone Detection Product
TRU	143	<input type="checkbox"/>	<input type="checkbox"/>	0	<= 0.0	Tornado Detection Rapid Update Product

This product has no extra parameters

Figure 10-9. RPG Product Distribution Control - Class 4 Users (Products 89-143)

RPG Product Distribution Control

Close Save Undo Baseline: Restore Update

User Class

☐ Class 2 Users [Permission] ☒ Class 4 Users [Distribution]

Filter Product List

Search: Sort by: ☐ Product Code ☐ Product MNE ☐ Description

MNE	Code	A	B	Freq	Elev/Cut(s)	Product	Description
CLR	132	<input type="checkbox"/>	<input type="checkbox"/>	0	<input checked="" type="checkbox"/> <= 0.0		Clutter Likelihood Reflectivity: 11 level/0.54 nm
CLD	133	<input type="checkbox"/>	<input type="checkbox"/>	0	<input checked="" type="checkbox"/> <= 0.0		Clutter Likelihood Doppler: 12 level/0.54 nm
DVL	134	<input type="checkbox"/>	<input type="checkbox"/>	0	<input type="checkbox"/> <= N/A		High Resolution Digital VIL: 256 level/0.54 nm
EET	135	<input type="checkbox"/>	<input type="checkbox"/>	0	<input type="checkbox"/> <= N/A		Enhanced Echo Tops: 71 level/0.54 nm
SO	136	<input type="checkbox"/>	<input type="checkbox"/>	0	<input type="checkbox"/> <= N/A		Superob: NCEP Winds Model Initialization
ULR	137	<input type="checkbox"/>	<input type="checkbox"/>	0	<input type="checkbox"/> <= N/A		User Selectable Layer Composite Reflectivity (Maximum)
DSP	138	<input type="checkbox"/>	<input type="checkbox"/>	0	<input type="checkbox"/> <= N/A		Digital Storm Total Rainfall Accumulation: 256 level/1.1 nm
MRU	139	<input type="checkbox"/>	<input type="checkbox"/>	0	<input checked="" type="checkbox"/> <= 0.0		Mesocyclone Rapid Update
MD	141	<input type="checkbox"/>	<input type="checkbox"/>	0	<input type="checkbox"/> <= N/A		Mesocyclone Detection Product
TRU	143	<input type="checkbox"/>	<input type="checkbox"/>	0	<input checked="" type="checkbox"/> <= 0.0		Tornado Detection Rapid Update Product
OSW	144	<input type="checkbox"/>	<input type="checkbox"/>	0	<input type="checkbox"/> <= N/A		One-hour Snow Accumulation (Water Equiv.): 16 level/0.54 nm
OSD	145	<input type="checkbox"/>	<input type="checkbox"/>	0	<input type="checkbox"/> <= N/A		One-hour Snow Accumulation (Depth): 16 level/0.54 nm
SSW	146	<input type="checkbox"/>	<input type="checkbox"/>	0	<input type="checkbox"/> <= N/A		Storm Total Snow Accumulation (Water Equiv.): 16 level/0.54 nm
SSD	147	<input type="checkbox"/>	<input type="checkbox"/>	0	<input type="checkbox"/> <= N/A		Storm Total Snow Accumulation (Depth): 16 level/0.54 nm
DMD	149	<input type="checkbox"/>	<input type="checkbox"/>	0	<input checked="" type="checkbox"/> <= 0.0		Mesocyclone Detection Data Array Product
USW	150	<input type="checkbox"/>	<input type="checkbox"/>	0	<input type="checkbox"/> <= N/A		User Selectable Snow Accumulation (Water Equiv.): 16 level/0.54
USD	151	<input type="checkbox"/>	<input type="checkbox"/>	0	<input type="checkbox"/> <= N/A		User Selectable Snow Accumulation (Depth): 16 level/0.54 nm

This product has no extra parameters

Figure 10-10. RPG Product Distribution Control - Class 4 Users (Products 132-151)

# Chapter 11

## Precipitation Categories

---

### 11.1 Precipitation Status

The Precipitation Detection Function (PDF) is designed to automatically determine if precipitation is occurring within 124 nm of the radar (Figure 11-1). The primary purpose of the PDF is for automatic initiation of Mode A (Precipitation Mode) as defined in the RPG Control window (Refer to Chapter 16). It is no longer used to initiate or determine the end of precipitation accumulations. That function is now accomplished by Hydromet Pre-processing (Refer to paragraph 8.5).

The PDF examines reflectivity returns from the four lowest elevation angles and compares them to the Precipitation Rate Threshold and an Area Threshold, which is the sum of the Precipitation Area Threshold and the Nominal Clutter Area Threshold. One of the following three Precipitation Categories is assigned to each volume scan depending on which combination of thresholds are met or exceeded:

- Category 0 - No precipitation detected
- Category 1 - Significant precipitation detected
- Category 2 - Light precipitation detected

When Precipitation Category 1 has not been detected during the past hour, any VCP can be selected. When the assigned Precipitation Category is 1, the radar can only be operated in a Precipitation Mode VCP (11, 12, 21, or 121).

Precipitation Status

Close

Modify Parameters

Time Until Clear Air: 60 minutes

Detection Algorithm Executed: Jul 6, 2004 - 15:05:34 UT

Category

Time Last Detected

Current: SIGNIFICANT (1)

LIGHT (2): Jul 6, 2004 - 15:05:34 UT

SIGNIFICANT (1): Jul 6, 2004 - 15:05:34 UT

Elevation Angle	Rate (dBR) Thresh	Refl (dBZ) Thresh	Area (km2) Thresh	Detect	Precip Category	Met
0.5	4.0	30.4	160	9257	SIGNIFICANT (1)	
0.5	-2.0	22.0	120	21564	LIGHT (2)	YES
0.5	4.0	30.4	160	9257	SIGNIFICANT (1)	YES

NOTE: Threshold Area = Nominal Clutter Area + Precipitation Area

Figure 11-1. Precipitation Status

## 11.2 Modify Precipitation Detection Parameters

Click on the Modify Parameters button of the Precipitation Status window and the Modify Precipitation Detection Parameters window appears (Figure 11-2). This window is password protected but does allow the URC LOCA.

Each line of the Modify Precipitation Detection Parameters window is defined by a Tilt Domain (elevation angle range), a Precipitation Rate Threshold, the Nominal Clutter Area and Precipitation Area Thresholds, and the resulting Precipitation Category.

Tilt Domain	Precip Rate Thrsh (dBR)	Nominal Clutter Area (Km2)	Precip Area Thrsh (Km2)	Precip Cat	
0.0	2.0	-2.0	100	20	LIGHT (2)
0.0	4.0	4.0	150	10	SIGNIFICANT (1)
2.0	4.0	-2.0	80	20	LIGHT (2)

To edit, select an item from the table followed by Modify or Delete

Figure 11-2. Modify Precipitation Detection Parameters

### 11.3 Modify Precipitation Table Item

Click on the Modify button in the Edit section of the Modify Precipitation Detection Parameters window and the Modify Precipitation Table Item window appears for the line selected (Figure 11-3).

Min Elevation Angle ( -1.0 - 45.0 deg)	0.0
Max Elevation Angle ( -1.0 - 45.0 deg)	2.0
Precip Rate Thrshld ( -30.0 - 50.0 dBR)	-2.0
Nominal Clutter Area ( 0 - 80000 km2)	100
Precip Area Thrshld ( 0 - 80000 km2)	20
Precipitation Category	LIGHT (2)

Figure 11-3. Modify Precipitation Table Item



The Nominal Clutter Area (NCA) is the only adaptable parameter on the Precipitation Detection window that may be changed under URC LOCA. All others are under ROC LOCA. The NCA allows the operator a way to account for residual clutter (i.e., normal propagation ground returns not eliminated by Clutter Suppression Regions). By setting the NCA for "SIGNIFICANT (1)" larger than the area of residual clutter, which is typically observed on days with no rainfall-producing echoes or anomalous propagation, it will prevent the radar from going into Precipitation Mode due to the presence of ordinary non-meteorological echoes. The NCA should be regularly monitored and set so that Precipitation Categories 1 and 2 are assigned by the PDF when real precipitation is occurring anywhere within range of the radar. In order to correctly set the NCA, the detected area of reflectivity returns can be checked on the Precipitation Status window. If there is an operational reason to keep the system in Clear Air Mode, ensure that the NCA for "SIGNIFICANT (1)" in Modify Precipitation Detection Parameters exceeds the "Detect" area in Precipitation Status. Otherwise, keep the NCA close to the typical amount of residual clutter.

The NCA value only affects the minimum areal threshold for assigning Precipitation Categories. NCA has no impact on the quality of radar data. Clutter Suppression, on the other hand, impacts all products. Thus, every effort should be made to filter normal and abnormal ground clutter at the RDA using Clutter Suppression Regions.

#### **NOTE**

The RAINA parameter in the Hydromet Preprocessing algorithm has replaced the Nominal Clutter Area (NCA) in the Precipitation Detection Function as the area to be exceeded before precipitation accumulations begin or continue (Refer to Section 8.7.4).

The PDF computes the areal coverage of return from all the reflectivities above the Rate Threshold values. The PDF does not discern between a ground return and a real precipitation target. In events where the PDF assigns a precipitation category incorrectly due to ground returns, the operator should first attempt to reduce the ground returns using clutter suppression, and then account for any residual clutter with the NCA Threshold. The NCA is only a threshold value, and has no effect on the base data.

The NCA should not generally be used to prevent the radar from switching into Precipitation Mode A due to the presence of anomalous propagation echoes. To prevent the radar from switching into Mode A when transient anomalous propagation echoes are the only echoes present, it is recommended to judiciously use operator-defined clutter suppression regions during the time when the anomalous propagation conditions are occurring. This will improve the quality of the base data products and, consequently, the derived products as well. Increasing the NCA in anomalous propagation situations will

not improve the quality of the base data since the anomalous propagation echoes will still remain in the products.

It is especially important to note that, if operator-defined clutter suppression regions cannot properly remove all of the anomalous propagation contamination and if, therefore, the decision is made to increase the NCA to prevent the radar from switching into Precipitation Mode A, then you should only increase the value of NCA for Precipitation Category 1. It is Precipitation Category 1 in the Precipitation Detection Function which controls what mode the radar operates in. If and when the NCA is increased to prevent the radar from switching into Precipitation Mode A because of the existence of anomalous propagation, the NCA must be promptly returned to the proper smaller value characteristic of residual clutter to permit the radar to operate properly and switch into Precipitation Mode when real rainfall begins.

## Chapter 12

# Clutter Regions

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### 12.1 Clutter Suppression Control

Clutter suppression is used to remove the power returned by clutter targets from a range bin *prior* to the calculation of the base data.

Ground clutter and Anomalous Propagation (AP) contamination have a significant effect on the accuracy of the base data. The clutter induced bias in the base data not only brings into question the reliability of the data presented on the base products but also has a detrimental effect on *all* downstream algorithms.

Clutter suppression filters are designed to reduce the power of those signals that have a mean radial velocity at or near zero. To do this, clutter suppression filters reduce signal power for targets within a notch width centered about the zero mean radial velocity value. This reduction in signal power effectively decreases the clutter's power contribution in the given range bin. To maintain meteorological return integrity, only the signal power whose radial motion falls within the notch width is reduced. Therefore, with appropriate clutter suppression invoked, the bias in the base data (R, V, and SW) estimates due to clutter contamination within the range bin can be minimized.

The clutter suppression regions, defined as Region 1 for both Low and High Segments, ensures the normal ground clutter pattern, as defined by the Bypass Map, is addressed. Click on the Clutter Regions Applications icon to bring up the Clutter Regions window (Figure 12-1). This region should always be included in each clutter suppression region file definition. Additional regions (operator select code All Bins forcing clutter suppression) should be defined as subsequent regions as needed to address transient clutter (e. g., AP).

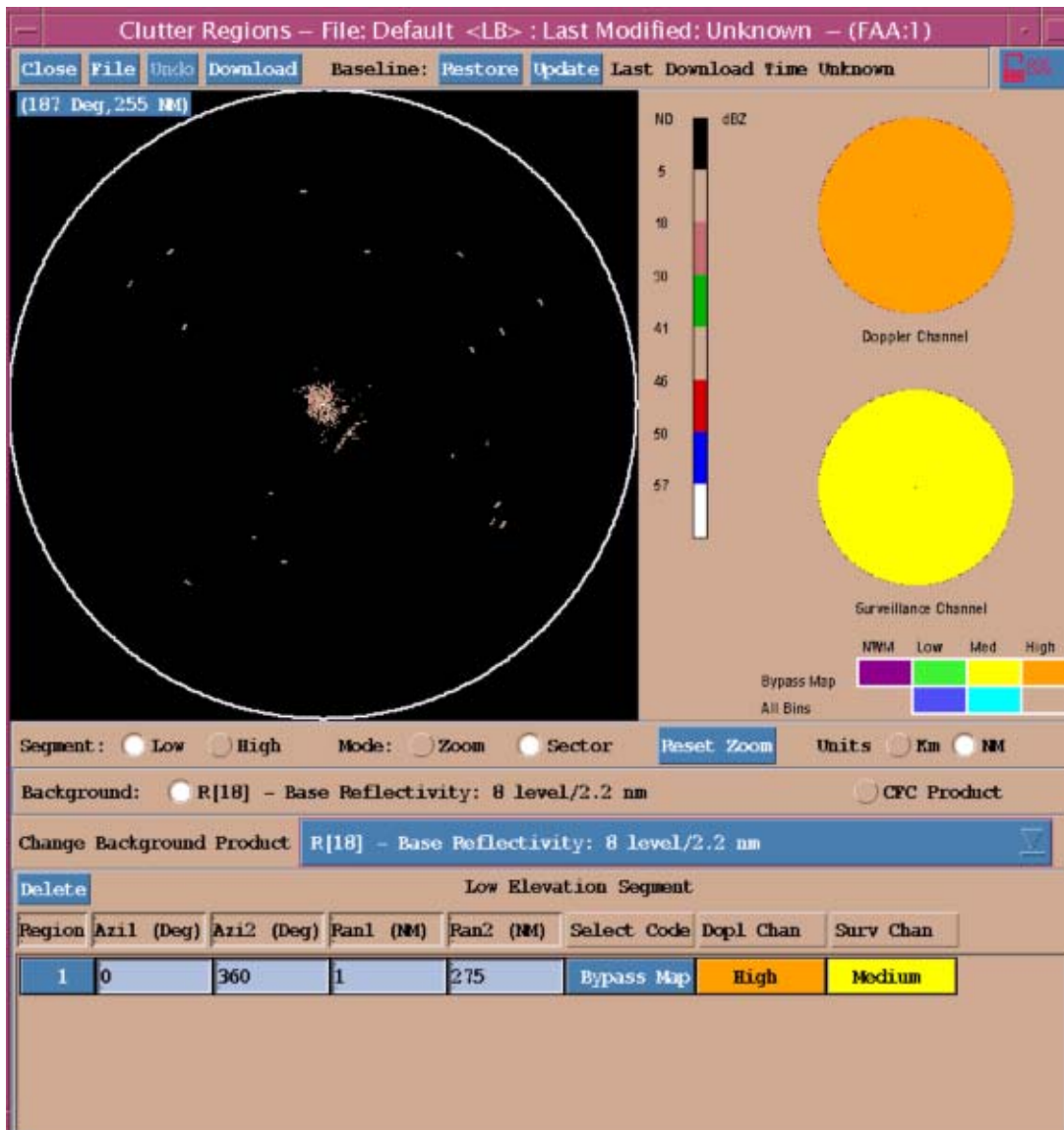


Figure 12-1. Clutter Regions

## 12.1.1 Operator-Defined Clutter Suppression Regions

The operator may define up to fifteen (15) individual regions per each of the twenty (20) allowed Clutter Region Files (See Figure 12-2). Clutter Suppression Region Files are not associated with any specific VCP. Each region is delineated by start and stop ranges, start and stop azimuths, and an elevation segment. The elevation segment (Low or High) specifies which set of predefined elevation slices to include within the region definition. The elevations included in the different segments are defined in the RDA adaptation data.

The Clutter Suppression Regions are used to control the application of clutter suppression within the defined area by selecting from the options listed below.

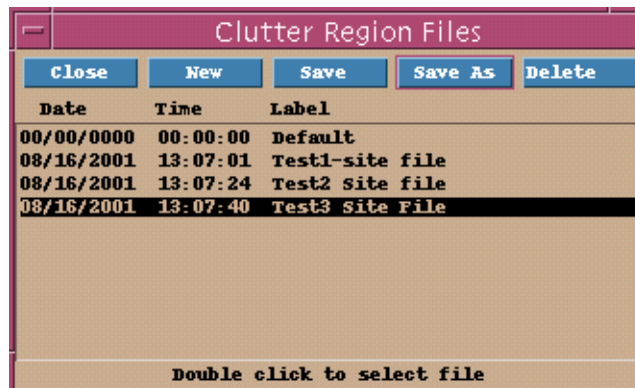


Figure 12-2. Clutter Region Files

#### 12.1.1.1 Options for Clutter Suppression Within Operator-Defined Regions

Within each operator-defined region, the operator has three choices to determine how filtering will be invoked.

- a. **No Clutter Suppression:** Select Code = None. This selection will turn off **ALL** filtering, including the Bypass Map identified areas, within the confines of the operator-defined region.
- b. **Bypass Map in Control Using the Operator-Specified Notch Width:** Select Code = Bypass Map. This selection will invoke the selected suppression level (notch width) for each area identified by the Bypass Map within the confines of the operator-defined region.
- c. **Forced Clutter Suppression Using the Operator-Specified Notch Width:** Select Code = All Bins. This option forces the specified suppression level (notch width) for every range bin within the confines of the operator-defined region.

#### 12.1.1.2 Notch Width Selections

There are three notch width selections, or levels of suppression, available for inclusion in the Default Notch Width Map definitions and Clutter Suppression Region definitions (with Select Codes None or Bypass Map). The notch width determines the target motions, around zero radial velocity, that will be subjected to signal power reduction (suppression). The Surveillance channel and

Doppler channel are suppressed using different notch width values (see Table 12-1) to reduce base data estimate bias in the different channels.

a. **Notch Width Selection Low (Green).** Invokes a suppression level of approximately 30 dB (Low). See Table 12-1 for typical notch width values.

b. **Notch Width Selection Medium (Yellow).** Invokes a suppression level of approximately 40 dB (Medium). See Table 12-1 for typical notch width values.

c. **Notch Width Selection High (Orange).** Invokes a suppression level of approximately 50 dB (High). See Table 12-1 for typical notch width values.

Table 12-1. Notch Width Selections and Suppression Values

Notch Width Selection	Low		Medium		High	
Channel	kts	dB	kts	dB	kts	dB
Surveillance	3.38 (±1.69)	≈30	4.85 (±2.43)	≈40	6.79 (±3.40)	≈50
Doppler	4.58 (±2.29)	≈30	6.05 (±3.03)	≈40	8.92 (±4.46)	≈50

### NOTE

By design, the notch widths vary based upon antenna rotation rate. Therefore, the value listed in Table 12-1 is an approximation and varies with elevation angle and antenna rotation rate.

With regard to forced clutter suppression (All Bins), the SMALLEST AREA and LOWEST LEVEL of suppression that will properly remove the ground clutter or Anomalous Propagation contamination of the base data should always be used. Use of the highest suppression level (Notch Width High) over all azimuths, ranges, and elevation angles has a strong detrimental effect on the integrity of all reflectivity and reflectivity-based products (such as precipitation and VIL) in those regions of real meteorological echoes that are located along the zero radial velocity isodop.

### 12.1.2 Supplemental Information - Clutter Regions

For additional information concerning the application of clutter filtering, refer to the following paper:

WSR-88D Clutter Suppression and Its Impact On Meteorological Data Interpretation, Chrisman, et al, Jan 1995, and available at <http://www.wdtb.noaa.gov/resources/papers/clutter/clutter.pdf>

## Chapter 13

### Bypass Map Editor

#### 13.1 Clutter Bypass Map Editor - Segment 1

This window allows the operator to edit the RDASOT-generated Bypass Map. Click on the Bypass Map Editor icon and the Clutter Bypass Map Editor, Segment Number 1 opens. Segment 1 is the Low Elevation Bypass Map 1.65 degrees of elevation and below. See Figure 13-1.

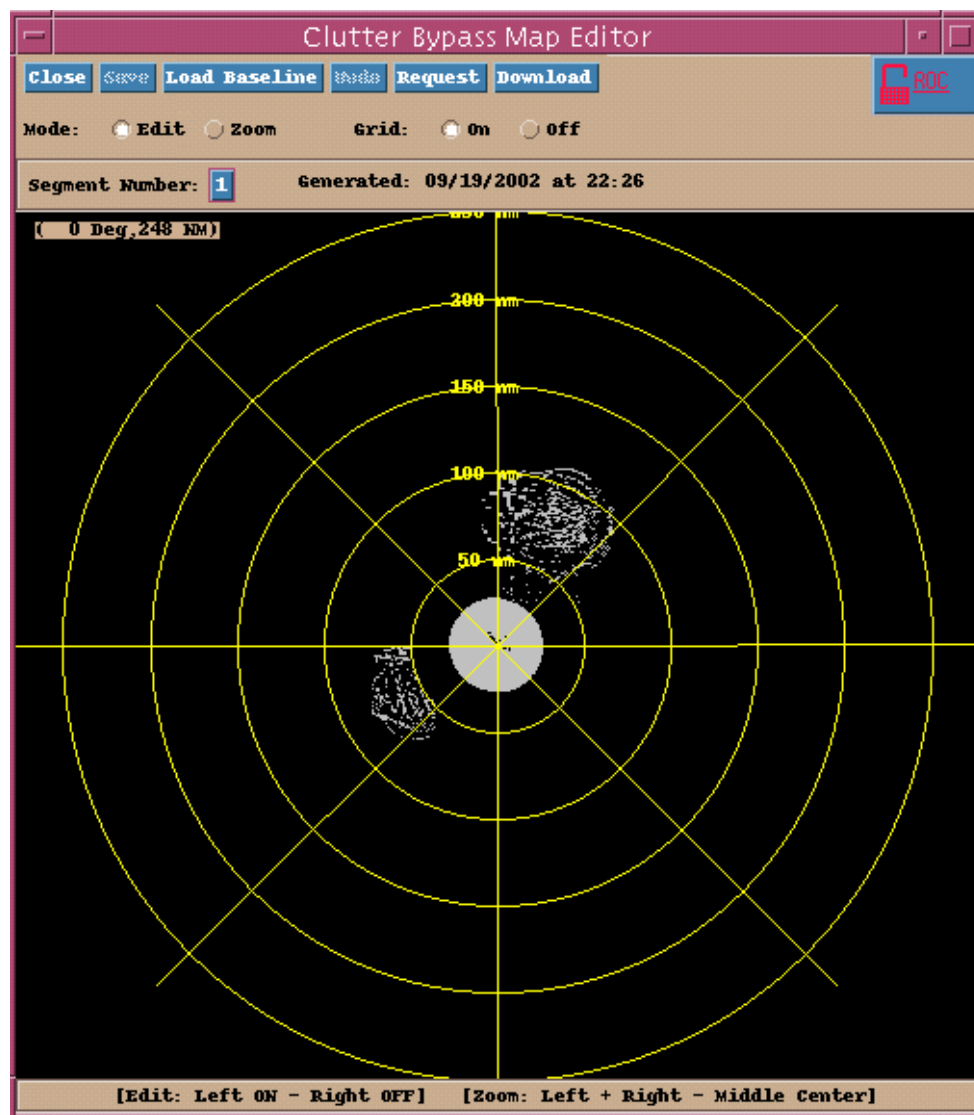


Figure 13-1. Clutter Bypass Map Editor, Segment 1



## NOTE

Manual editing of the Bypass Map is not recommended and should rarely be done.

### 13.2 Clutter Bypass Map Editor - Segment 2

Once the Clutter Bypass Map Editor window is open, click on the Segment Number block, and the Number 1 toggles to Number 2. Segment Number 2 Map is the High Elevation Bypass Map, above 1.65 degrees in elevation. See Figure 13-2.

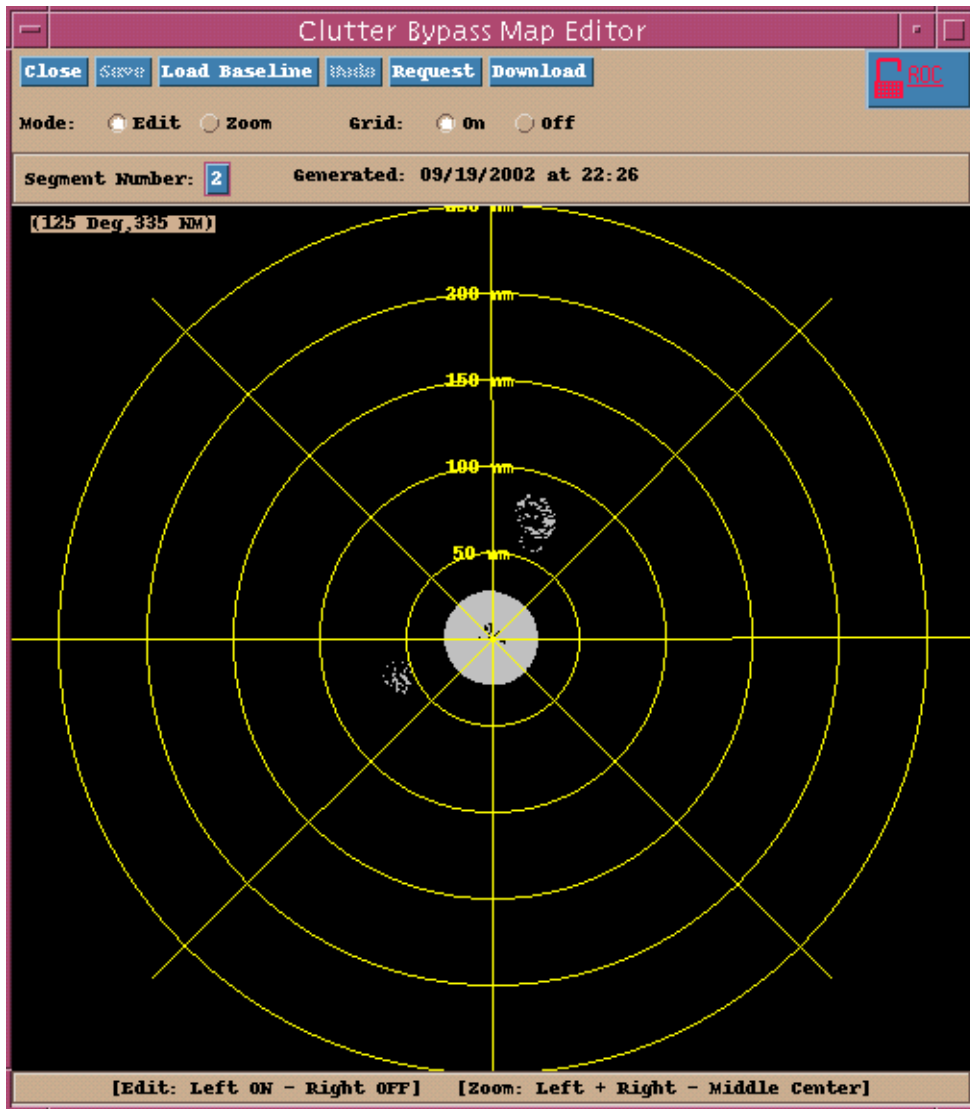


Figure 13-2. Clutter Bypass Map Editor, Segment 2

## Chapter 14

# Environmental Data

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### 14.1 Environmental Data Editor

The Environmental Data Editor is a list of wind speeds and directions at 1000 ft intervals from the surface to 70,000 ft MSL. The Velocity Dealiasing algorithm uses information from the environmental data editor when there is no continuity available to dealias suspect velocity estimates. With the VAD Update Feature enabled, the wind speeds and directions are updated every volume scan by the Velocity Azimuth Display task. Additionally, manual modification of this table is possible. The Environmental Data Editor window is used to observe the current values being used by the algorithm, as well as to modify the values to ones that better reflect the ambient wind field. See [Figure 14-1](#).

Occasionally aliased velocity data is not handled well by the Velocity Dealiasing Algorithm. One possible cause may be that the current Environmental Data Editor does not accurately reflect the ambient wind field. When this occurs, use other reliable sources for upper air data, manually update the Environmental Data Editor, and ensure the Auto VAD Update function is on.

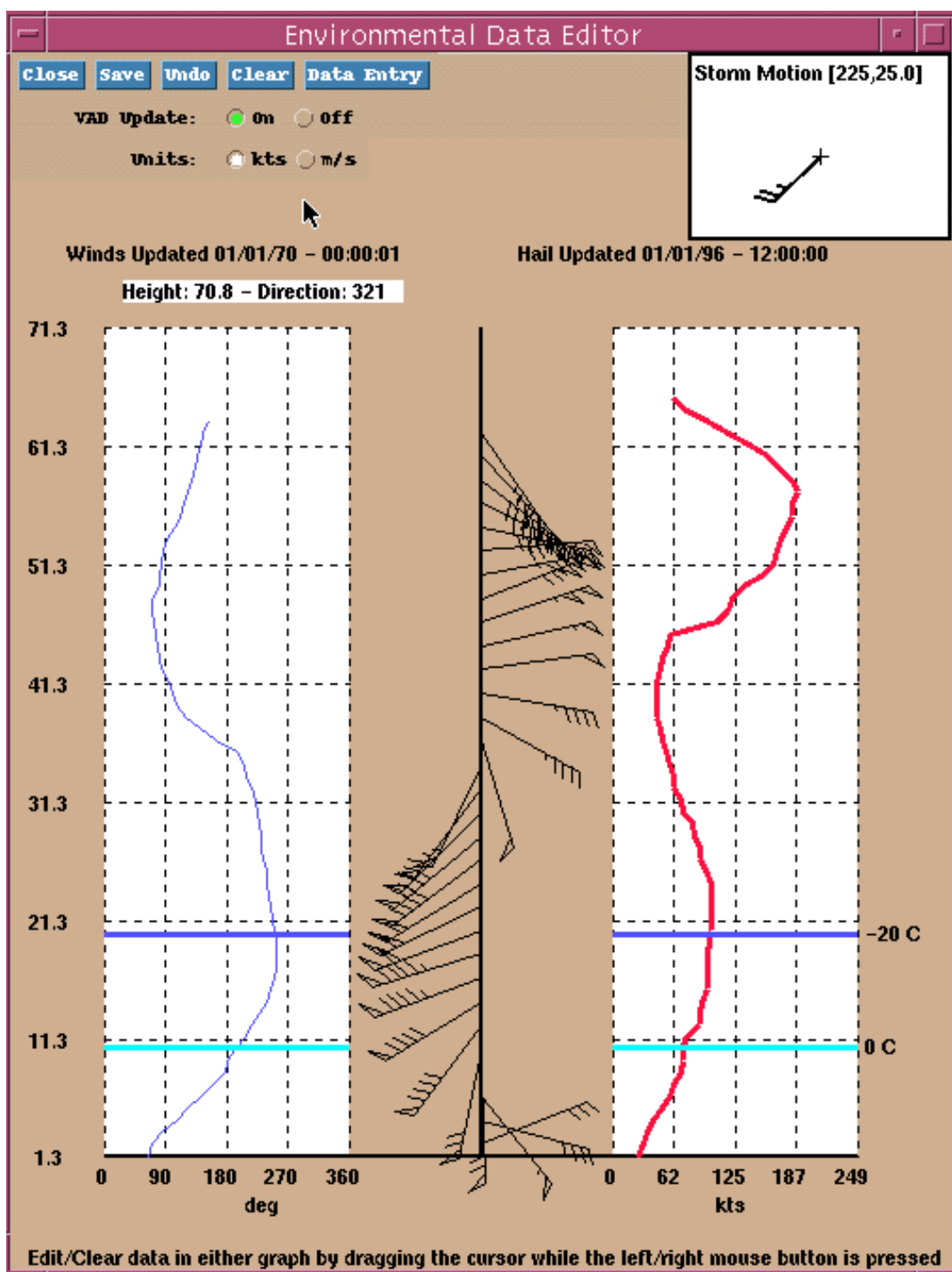


Figure 14-1. Environmental Data Editor

## 14.2 Environmental Data Entry

Click on the Data Entry button in the top line of the Environmental Data Editor and the Environmental Data Entry window appears. See Figure 14-2. You can enter the data in a tabular format in this window. Selecting the Clear button will clear out the entire data table. Should you mistakenly do this, you can correct this by selecting Close on the Environmental Data Entry window, then selecting Close on the Environmental Data Editor window.

**Environmental Winds Data**

Coded Msg (PPBB):

☒ Interpolate between levels

Lvl kft	Dir deg	Spd kts
1.3	64	24.9
2.3	69	30.6
3.3	83	36.4
4.3	105	42.1
5.3	122	49.8
6.3	141	57.5
7.3	158	63.2
8.3	177	69.0
9.3	180	70.9
10.3	191	70.9
11.3	205	74.7
12.3	216	88.1
13.3	227	90.0
14.3	238	91.9
15.3	244	95.8
16.3	249	95.8
17.3	252	95.8
18.3	252	95.8
19.3	252	97.7
20.3	249	99.6
21.3	246	99.6
22.3	244	99.6

**Hail Temperature Heights**

Last Update: 01/01/96 - 12:00:00

Height -20 c (0-70 kft MSL)

Height 0 c (0-70 kft MSL)

**Default Storm Motion**

Direction (0-360 deg)

Speed (0-99.9 kts)

Figure 14-2. Environmental Data Entry

### 14.3 Hail Temperature Heights/Default Storm Motion

These parameters are located in the upper right hand corner of the Environmental Data Entry window. They are not password protected and can be changed at any time. See Figure 14-2.

#### NOTE

For redundant configuration systems with two RPGs, the environmental data editable by the site does NOT get transferred from one channel to another when a change is made, nor when the channels are switched. These parameters are:

- 0 Deg C Height
- -20 Deg C Height
- Default Storm Motion

They will also NOT appear as a MISMATCH on the Adapt Times: line in the lower right hand corner of the RPG Control/Status window if the two channels have different values.

Changes made to these three values in the Environmental Data Editor are automatically transferred to the Hail Detection Algorithm and the Storm Cell Tracking Algorithm for that respective channel only.

Any changes to these three parameters should be made on the Environmental Data Editors for both channels at the same time to ensure optimum performance by the algorithms.

The environmental winds are also not transferred over during a channel switch. But the VAD Update option, when selected, will input the latest available wind data onto the new channel as each volume scan is completed.

## Chapter 15

### Passwords

#### 15.1 Passwords

The URC LOCA password may be changed for security reasons at each site. To change the URC password, click on the HCI Properties Applications icon. The HCI Properties window appears (Figure 15-1). Click on the Passwords button, and the Change Passwords window appears (Figure 15-2). Select the URC button, and enter in the old and new passwords, as appropriate.



Figure 15-1. HCI Properties

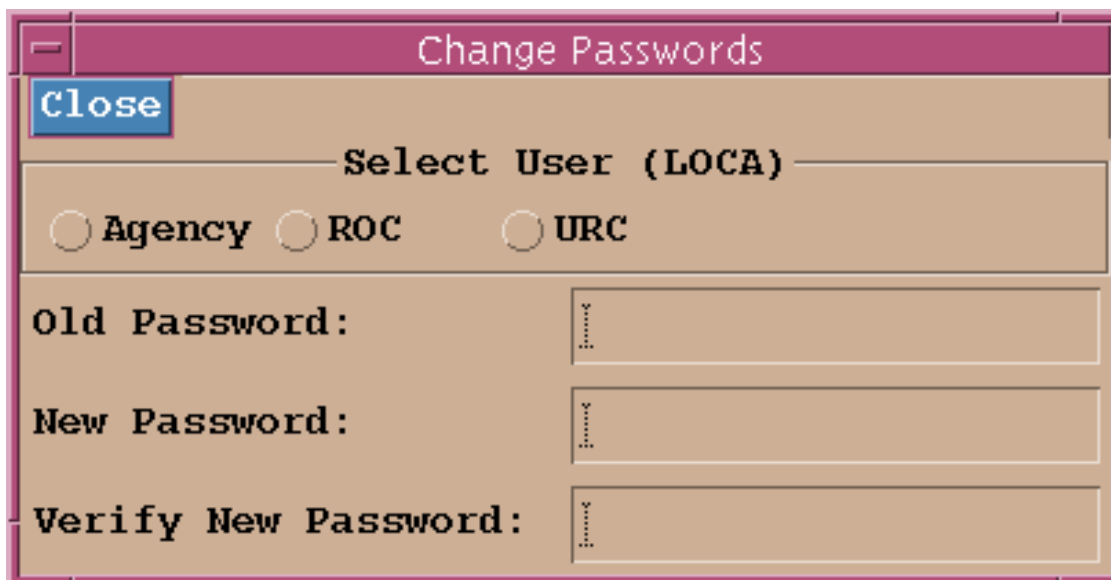


Figure 15-2. Change Passwords

## Chapter 16

### RPG Control - Default Weather Mode

#### 16.1 Default Weather Mode

This option defines the mode that the RPG will return to if it is turned off/on. If the system is restarted, it will return to its previous state, not the default weather mode. The choice of the default weather mode is allowed with the URC LOCA password.

Click the RPG Control icon; the RPG Control window will open. Under the System Control area is the line stating: Default Weather Mode: with a text string that follows. The options are either Clear Air (B) or Precipitation (A). See Figure 16-1. The mode can be changed by clicking on the text string and selecting Yes.

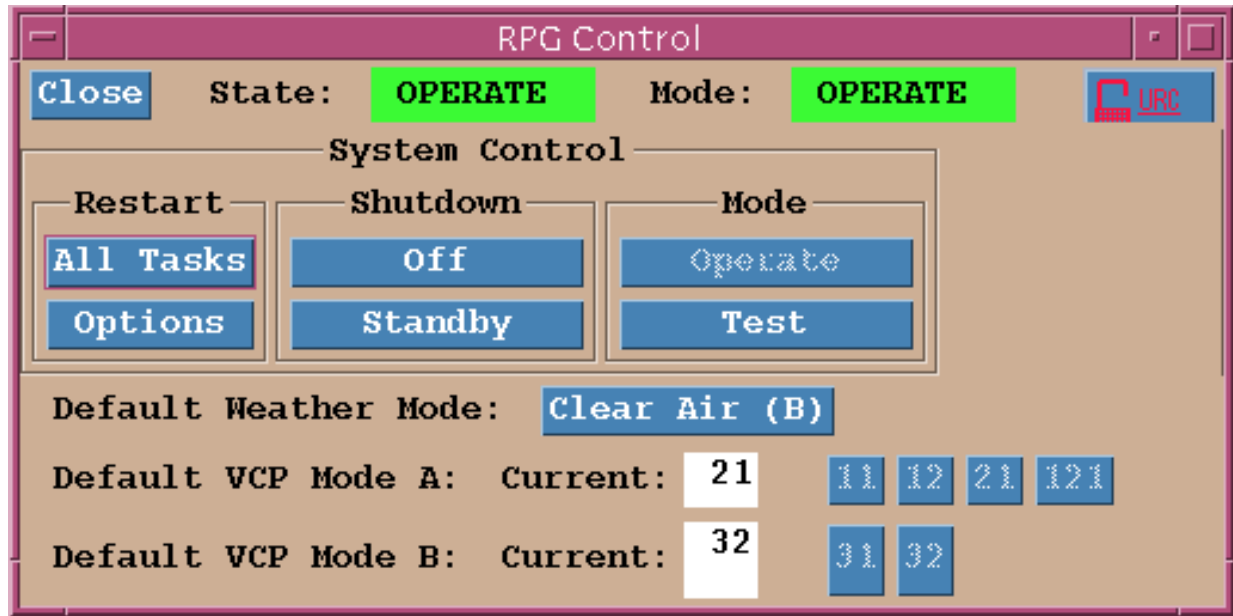


Figure 16-1. RPG Control